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ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with every copy of this week's issue

The First Main-Line Railway

SEPTEMBER 17 marks the centenary of a very important landmark in British railway history, for it was on this day in 1838 that the first trunk railway line was completed throughout, and for the first time rail transport was afforded the opportunity of demonstrating its enormous potentialities. Previous railways had established both passenger and goods services, had introduced locomotive traction, and had even carried mails, but their spheres of activity and influence had been local or at the most semi-local, and it was not until the last link of the London & Birmingham Railway was completed that a chain of rail transport was available joining important and distant industrial centres with the Metropolis. Probably no single development has exercised a more profound and lasting influence upon the commercial and social life of the country, and although centenaries of local railways are becoming almost an everyday occurrence, the centenary of the first main-line railway occupies an outstanding position. We have already recorded some of the plans of the L.M.S.R. regarding the centenary exhibition at Euston, and we ourselves are contributing to the occasion a special supplement to THE RAILWAY GAZETTE which will accompany every copy of next week's issue.

The Nigerian Directorate of Transport

In our issue of May 13 last we published a leader upon the first annual report issued by the Director of Transport in Nigeria, but since then the following further points in that report appear to us worthy of mention. In advocating the departmental as opposed to the divisional system of organisation for colonial railways, the report expresses the view that there is no room on a comparatively small colonial railway for two mechanical authorities, one responsible for the design and construction of locomotives and rolling stock, and the other for their performance and operation, as the divisional system presupposes. This opinion certainly agrees with our experience of the rather smaller railways in other parts of the Empire. Turning to the remarkable recovery of Nigeria from the recent trade depression, the report emphasises that the demand for coal has been unprecedented, as also has been the export of ground nuts, the haulage of both these commodities demanding exceptional efforts by the staff. The average tonnage hauled per train increased by 16 per cent., and the average wagon load was higher by as much as 38 per cent. The combination of minimum staff and maintenance with such tonnages produced the remarkable operating ratio of 43.64 per cent., "too low a figure, and one unlikely to be repeated." No effort is being spared to increase progressively "throughout" speeds of trains, by analysing in detail the loading of trains, station delays, and other factors, the ultimate goal being the consequent improvement in rolling stock turn-round.

The Week's Traffics

In comparison with the corresponding week in 1937 the four main-line companies report a decrease of £174,000 for the past week, as against one of £270,000 for the week before that. Receipts to date are £107,396,000, a decrease of £3,703,000 or 3.33 per cent. in comparison with the first 35 weeks of 1937. Passenger train earnings are down £257,000, merchandise £2,663,000, and coal £783,000.

| | 35th Week | | | | Year to date | |
|-------------|------------|------------|-----------|----------|--------------|--------|
| | Pass., &c. | Goods, &c. | Coal, &c. | Total | Inc. or Dec. | % |
| L.M.S.R. .. | + 6,000 | - 70,000 | - 1,000 | - 65,000 | - 1,543,000 | - 3.45 |
| L.N.E.R. .. | + 5,000 | - 34,000 | - 18,000 | - 47,000 | - 1,251,000 | - 3.84 |
| G.W.R. .. | - 4,000 | - 34,000 | - 10,000 | - 48,000 | - 728,000 | - 3.88 |
| S.R. .. | - 10,000 | - 6,000 | + 2,000 | - 14,000 | - 181,000 | - 1.20 |

The following table compares the 1938 traffic position of the four companies with that for the corresponding periods in 1936:—

| | 35th Week | | | | Year to date | |
|-------------|------------|------------|-----------|----------|--------------|--------|
| | Pass., &c. | Goods, &c. | Coal, &c. | Total | Inc. or Dec. | % |
| L.M.S.R. .. | + 41,000 | - 59,000 | + 11,000 | - 7,000 | + 339,000 | + 0.79 |
| L.N.E.R. .. | + 9,000 | - 8,000 | - 6,000 | - 5,000 | + 311,000 | + 1.00 |
| G.W.R. .. | + 4,000 | - 18,000 | + 6,000 | - 8,000 | + 281,000 | + 1.58 |
| S.R. .. | + 22,000 | - 5,000 | + 1,000 | + 18,000 | + 489,000 | + 3.39 |

Compared with the first 35 weeks of 1936 the traffics of the four companies to date in 1938 show increases of £2,118,000 from passengers and of £668,500 from coal, but a decrease of £1,366,500 from merchandise.

* * * *

An L.M.S.R. East Coast Port

Although the dock authority at Goole is the Aire & Calder Navigation, the L.M.S.R. has large interests and operates all the railway services in the port, under numerous long leases and tenancies, and has also provided many of the buildings and mechanical appliances. According to a recent article in *Quota News* (the journal of the L.M.S.R. Commercial Department), Goole Docks have a total water area of about 46½ acres, a quayage of three miles, and nine docks. With certain improvements now being carried out in the Rivers Ouse and the Humber it is anticipated that the port will be accessible for vessels with cargoes up to 4,000 tons—double the present limit.

The docks are mainly concerned with the Continental shipping trade and among the many commodities handled by the L.M.S.R. appliances in 1937 were 1,353,426 tons of coal, coke, and pitch. Container traffic has been extensively developed—about 2,000 a year are received or dispatched. At the West Dock a spacious shed with overhead electric cranes has been erected, and the quay is equipped with electric luffing cranes and grabs for the quick discharge of bulk traffic. The introduction of these cranes has resulted in a very large increase in bulk traffic, chiefly timber, scrap iron, sand, iron and steel, and ores of various descriptions. A special type of grab has been provided for dealing with the large tonnage of imported scrap metal.

* * * *

Overseas Railway Traffics

The Buenos Ayres Great Southern has improved its traffic position during the past fortnight to the extent of £12,283 and the Entre Rios shows a net increase of £931 during the same period, which makes its increase to date £9,535. A net decrease of £857 has, however, been suffered by the Argentine North Eastern in the two weeks, bringing its aggregate increase down to £5,749. Central Uruguay traffics have improved during the fortnight by £2,303 and by \$13,910 in currency.

| | No. of Weekly Week Traffics | Inc. or Decrease | Aggregate Traffic | Inc. or Decrease |
|--------------------------------|--------------------------------|---------------------|----------------------|---------------------|
| Buenos Ayres & Pacific .. | 10th 68,859 | — 9,987 | 678,042 | — 88,149 |
| Buenos Ayres Great Southern .. | 10th 121,650 | + 12,159 | 1,161,043 | + 27,172 |
| Buenos Ayres Western .. | 10th 31,452 | — 10,856 | 345,036 | — 93,985 |
| Central Argentine .. | 10th 92,339 | — 26,991 | 960,324 | — 354,435 |
| Canadian Pacific .. | 35th 910,800 | + 72,400 | 16,912,400 | + 1,237,000 |
| Bombay, Baroda & Central India | 22nd 204,525 | — 15,225 | 3,594,600 | — 101,175 |

Canadian Pacific gross earnings for the first seven months of 1938 amount to £14,475,600, a decrease of £1,290,800, and the aggregate net earnings of £637,600 represent a loss of £1,233,600.

* * * *

Prizes for Best-Kept Stations

The question of the money value of prizes in railway station garden competitions having been raised by a correspondent in our August 5 issue, the actual sums distributed among the winning L.N.E.R. (N.E. Area) stations listed last week will doubtless be of interest. Three stations received the special class prize of £6, and no fewer than 36 qualified for the first class £4 award. Second class prizes (£3 to 48 stations) totalled the same as the first class, namely, £144, and £130 went to the 65 winners of the third class prize of £2. With 86 stations claiming the fourth class (£1 award), the total disbursement was £522. Stations adorned with gardens and other floral displays in the N.E. Area are far from being oases in an otherwise dreary prospect, for much attention is paid to the appearance of the lineside between stations by the permanent way staff. This improvement was initiated by Mr. John Miller, formerly Engineer of the Area, and typical examples of his improvement schemes were illustrated in our issue of October 19, 1934. The concrete work which forms borders for stretches of grass and flower-beds, as well as for imparting a neat appearance to essential lineside accessories, is also used by the station staff in their own efforts.

* * * *

Appearance that Counts

Displays of flowers and shrubs are the manifestation of best-kept station competitions that first strike the eye of the public, despite the avidity with which it criticises any neglect of the more humdrum amenities. As a matter of fact, pleasant adornment and convenient appointments are encouraged together by the L.N.E.R. contest mentioned in the preceding note, marks being awarded under

both heads. Attention is paid, for instance, to orderly appearance of platforms and tidiness of platform lines, for a dismal impression is made upon a passenger waiting for a train by the sight of last week's newspapers, sodden with rain, blowing at his feet, or spent matches and cartons from penny-in-the-slot machines littering the permanent way. Why is it that in describing a railway station one drifts so easily into a vein of drab realism? Another point considered is neatness in timetable display, and the judges also doubtless take cognisance of appropriate situation. Sometimes, not in the N.E. Area, or, in the particular instance we have in mind, even on the L.N.E.R., we have seen the times of down trains, Mondays to Fridays, exhibited with consummate neatness only on the up platform.

* * * *

Smart Work at Grove Park

On page 459 we publish some details of the highly efficient and expeditious manner in which the signalling at Grove Park, Southern Railway, was restored to use after the box had been seriously damaged by fire on August 23. The old signal box, built in 1905, was of a type that at one time appeared likely to be more generally adopted than eventually proved the case, although the electro-mechanical system, using miniature lever handles mounted over the mechanical point levers, found some favour later in America. The new well-equipped box has an ordinary lever frame for all functions, electric signals being worked through circuit controllers on the standard practice now adopted by the Southern for such installations. Very close team work has been required to produce the necessary plans, collect the material and complete the work in so short a time, and all concerned are to be congratulated on the success of their efforts. The inconvenience to the public was fortunately reduced to an absolute minimum by the existence of a bay line into which a Bromley shuttle service could run, while the signalling on the main lines could be put out of use, leaving everyone free to concentrate on the restoration work—fortunately aided by fine weather. Had it been necessary to keep the junction in work it would hardly have been so simple to deal with the traffic.

* * * *

The Alignment of Railway Curves

Mr. P. E. Knight, the author of the book entitled "String-lining of Railway Curves," which is reviewed on page 445, is Resident Engineer of the Midland Uruguay Railway and associated lines. He has obviously made an exhaustive study of the whole subject of curve alignment, and, after thoroughly examining and testing various means, is left with no doubt that the string-lining method is the best for all but extraordinary applications. Although it has only during the last few years become a recognised feature of railway practice all over the world, the principles involved are by no means new, and the author has performed the useful and much needed service of lucidly collating the work of the pioneers. In emphasising the simplicity and practicability of the method, he remarks that the necessary equipment can be carried in the pocket. No theodolites or precision instruments are needed, and no thin wires or micrometers. A hank of strong string or fishing line, a rule with the divisions starting at one end, and a piece of grease chalk; for the calculations, a child's slate; for the rest, the rule or gauge, and the usual stakes, sledge, &c. In hot countries heat-shimmer often compels the temporary suspension of instrument work, but nothing need stop string-lining except high winds, which also interfere seriously with the use of a theodolite. The simple practical method described in this welcome textbook enables the engineer responsible to see at a glance before-

hand exactly what his assistants on the spot propose in the way of slueing, an obvious advantage in the conditions that prevail in many parts of the world. Mr. George Ellison who, during his tenure of the office of Chief Engineer of the Southern Railway, has been responsible for the remarkable improvement in the standard of that company's permanent way, contributes an appreciative foreword.

* * * *

Modern Signalling in Brazil

A good example of the way in which up-to-date signalling methods are being recognised in overseas countries as essential to the complete success of electrification on suburban lines, is to be found in the new colour-light signalling on the Central Railway of Brazil, an illustrated description of which appears on page 455. The close headway called for in modern suburban electric services makes every second of value. There is no time to spare for working block instruments. Power signalling thus becomes a necessity, and in addition to providing the required rapid changing of the signal aspects the instant conditions are right for it to take place, it gives a considerably higher degree of safety than any purely manual system of signalling can do, unless continuous track circuiting, or an equivalent, is added to it. A good deal of modern signalling equipment is now to be found elsewhere on the Brazilian railways, including hand generator apparatus, and some time ago it was announced that the Government was trying to introduce a certain measure of standardisation into signalling methods, which vary somewhat at present between different lines.

* * * *

Rear Protection of Passenger Trains

Few passages in Colonel Mount's recently-published annual report (reviewed in our issue of August 5, page 236) are more welcome than that which reads: "with regard to the use of the stop and proceed rule on lines in the London area, which in the main carry passenger trains only, agreement has been reached with the L.P.T.B. and L.M.S.R. with regard to the provision of more powerful (electric) tail lamps for all new and existing rolling stock." We have consistently advocated better side or tail light protection for passenger trains, notably on page 95 in our issue of July 19, 1935, and on pages 5 and 6 in our issue of July 3, 1936. Had electric tail or side lights been fitted to the trains involved in the collisions at, for example, Welwyn and Castle Cary, it is likely that, if indeed these collisions had not been prevented, their effects would at least have been greatly reduced. On the electrified sections of the Southern Railway, where extra vehicles may not be attached in rear of multiple-unit sets, the retention of the primitive and often smoky oil tail lamp verges on absurdity. And even on steam-worked lines, if movable tail lamps are still considered necessary, surely electric side lamps might be used, as in India and elsewhere, as pointed out in our editorial referred to above.

* * * *

A Concrete Pump in Railway Work

Railway engineers are often prevented from using concrete for bridge and other work because of the space occupied by the mixing plant and the difficulty of conveying the concrete across the permanent way, without interfering with traffic, to the point required. At Wembley Park, in the construction of a flyover junction, this difficulty was overcome (by the L.P.T.B. engineers and the Cleveland Bridge and Engineering Co. Ltd., contractors) by the use of a concrete pump, an apparatus recently introduced from America. This pump, specially designed to handle concrete, takes the full output from a 1 cu. yd. mixing plant conveniently situated beside the track and

delivers it through a 6-in. steel pipe which passes under four electrified tracks (carrying full traffic) to the point required some 200 yd. away. It might be thought that it would be necessary to use a very liquid concrete, but this is not so. All that is necessary is that there should be plenty of sand present, about 40 per cent., and sufficient cement to ensure strength; a stiff tacky mix gives the best results. At the end of each day's work the delivery pipe must, of course, be emptied, otherwise the concrete would harden into a solid mass. The removal of the concrete is effected by blowing compressed nitrogen, the cheapest form of gas, down the tube. About five cylinders are sufficient to empty the pipe.

* * * *

A Rail Grinding Experiment

Some interesting experiments have been made recently by the London Passenger Transport Board with the object of producing an improved apparatus to grind out rail corrugations, a particularly objectionable feature on underground lines because of the noise they produce. For these experiments a special machine was designed and constructed at Acton works for which a provisional patent has been obtained. It consists of a vehicle arranged to travel at a slow steady speed, carrying two electrically driven grinding wheels 49½ in. in diameter on a horizontal axis of as large a diameter as could conveniently be fitted. The wheels are like ordinary flanged running wheels but with the whole of the tread portion composed of a number of shaped segmental grinding blocks forming a continuous grinding surface capable of easy and economical renewal when worn. They are driven at a surface speed of about 4,000 ft. per min., and their axis can be moved vertically under restraint in such a way that more pressure is automatically brought to bear on the high points of the corrugations than on the low ones. The combination of this arrangement with the wheel of large diameter produces a smooth level surface on the head of the rail. The machine is also fitted with an arrangement by means of which the average pressure of the grinding wheels on the rail can be varied, without the risk of an unskilled operator applying an abnormal pressure which might damage the grinding blocks.

* * * *

Ballast Supplies

The former North Eastern Railway was remarkable as a self-contained system, that is to say it served—and served well—an area which was entirely free of competitive metals. Its care that no one else should participate in its traffic was also extended into other departments—the company was a very large dock and hotel owner—but besides these there were a number of smaller undertakings, amongst them two quarries, which were acquired to supply permanent way ballast. One of these, at Hulands, near Barnard Castle, provided limestone, while the other at Lackenby, near Middlesbrough, was actually a slag heap, being material tipped from ladles which was deposited about 1870 from the Old Cleveland iron ore foundries. Today, under the ægis of the L.N.E.R., these two undertakings are still in active service, though the material in the latter will be exhausted within the next few years. Normally 60 men are employed at Hulands and 85 at Lackenby. Among the more notable purposes to which the products of these quarries have been put was the ballasting in recent years of the entire main line of the old N.E.R., from Shaftholme junction, near Doncaster, to Marshall Meadows, near Berwick; and of the electrified lines in the Newcastle area. Some details of ballast production from these sources are given in an article on page 465.

Travel Savings Schemes

IT seems that expectations of bumper holiday passenger traffics as the result of the holidays-with-pay movement were a little over-sanguine, or at any rate, somewhat premature. In many cases, it is suggested, men receiving holidays with pay for the first time were unable to visit seaside or other resorts owing to there being insufficient time in which to save the necessary money. Doubtless for this reason the railway companies have received a number of suggestions that they should inaugurate travel savings schemes to enable prospective passengers to begin saving at once for their holidays next year. It is appropriate, therefore, to point out that the four main-line railway companies, together with their associated joint lines, have operated comprehensive travel savings schemes for several years. About ten years ago the L.N.E.R. introduced an arrangement under which small sums were collected weekly, by the sale to the public of value tickets of various denominations, towards the cost of railway journeys. The same company then made an arrangement with the Yorkshire Penny Bank and certain trustee savings banks in the North of England and Scotland under which special facilities were afforded depositors to open holiday savings accounts. By this means any depositor desiring to make a railway journey could obtain a travel voucher from the bank and exchange it for the appropriate ticket at the station without any money passing at the time and with the knowledge that a discount of 5 per cent. would be obtained from the railway fare. A similar practice was later adopted by the L.M.S.R., and both schemes are still in operation, although they are limited to depositors at the banks in question.

In 1933 the G.W.R. introduced a more comprehensive scheme in South Wales, under which travel savings cards were issued free to the public. These cards provided spaces for twenty ordinary sixpenny stamps to be affixed. When the cards were filled, they were exchangeable at any G.W.R. station or booking office in full or part payment for railway tickets. This innovation proved so successful that it was extended subsequently to the whole of the system, with encouraging results. In 1936 the L.M.S.R., L.N.E.R. and Southern Railway Companies introduced schemes under which "save to travel" stamps of one shilling denomination could be purchased at any of their stations or offices. These stamps have to be affixed to cards supplied free of charge by the companies and are then accepted in exchange for railway tickets of the appropriate value. A special feature of these schemes is that 5 per cent. interest a year is paid on every completed ten shillings for every completed month, with a maximum of twelve months. Also, if desired, vouchers costing ten shillings each can be purchased.

All the main-line companies accept the stamped cards or vouchers for all descriptions of railway tickets other than season tickets, and they can also be used in payment of such incidentals as seat reservations, and sleeping accommodation. The schemes of the four companies are worked quite independently and, for reasons of accountancy, the stamps and vouchers of one company cannot, at present, be exchanged for tickets at another company's station. Apart from these individual schemes, all the companies have for some years made a practice of supplying holiday savings cards free of charge to party promoters in works, schools, shops, and other establishments, to promote saving for holidays and outings. Under this arrangement the excursion organiser is responsible for the weekly collection and custody of the subscriptions, while the railway companies' representatives keep in close touch with the responsible official to secure the party's patronage. While these various arrangements are frequently advertised by

means of posters and handbills, and also by the companies' representatives in their dealings with the public, it may be that further advertising associated with the holidays-with-pay movement will secure a wider interest in a practice which has already yielded valuable results to the companies.

* * * *

The Bihta Derailment

IN connection with the opening of the Indian Pacific Locomotive Committee's inquiry in India this month, it is opportune to summarise the salient facts connected with the occurrence and relevant inquiries in so far as they are known to us. On July 17, 1937, between 3.50 and 4.0 a.m. No. 18 down Punjab express was derailed whilst crossing a recently-completed flood opening, No. 191, about 500 yd. west of the signal cabin at Bihta station on the main line of the East Indian Railway. The train consisted of "XB" class 4-6-2 locomotive No. 1916 and tender, and ten bogie coaches, including two brake vans and an Indian dining car. It carried 450 passengers, most of them in the leading coaches; 107 were killed and 117 were injured and detained in hospital. The engine after becoming derailed capsized and the first five coaches piled up and telescoped, the sixth and seventh remained intact but were derailed, and the last three coaches were neither derailed nor damaged.

Mr. H. A. Joscelyne, Senior Government Inspector of Railways, examined the wreck shortly after the derailment and held the technical enquiry. He submitted his report upon it to the Railway Board early in August, but, in accordance with practice in India,* this report was not published, though it was subsequently printed as a White Paper for use in connection with the judicial enquiry, and we have seen only extracts from it published in Sir John Thom's judicial finding. Briefly, Mr. Joscelyne's finding was that "XB" engine No. 1916 had a strong proclivity for violent hunting at high speeds, but that so long as it was running on 88½-lb. bull-head rails on Denham-and-Olphert cast-iron plate sleepers the tendency to side thrust was checked. The new embankment at the flood opening was laid with similar rails on wooden sleepers, a form of track considered by the inspector to be weaker, and it immediately gave way to the thrust and became distorted for several inches on either side. So long as the engine was on this yielding track it kept the rails, but the moment it returned to the D.-&O. plate road—which at that point was also anchored both horizontally and vertically over the bridge—it jumped the metals. Summarising he says, "I find that the accident was due to derailment of 'XB' class engine No. 1916 caused by hunting while running at excessive speed over track that was not sufficiently strong to withstand the strain thrown on to it."

The railway administration could not agree with the Government Inspector's finding, and held that hunting was started by a defect in the permanent way, and that but for the wooden sleeper road on the new embankment, hunting would not have distorted the track as it did. It also pointed out that, possibly due to lack of experience, the driver did not realise the seriousness of the hunting until too late to shut off steam; also that the disastrous consequences of the accident were mainly due to the low spring hangers of the bogie tender, which are bound to drop below rail level and foul the chairs (or D.-&O. plate jaws) fishplates and bolts, when a wheel comes off the inside of the rail. Striking all these projections they pull up the train abruptly, causing additional telescoping. In

* Government inspectors' reports are treated as confidential, but are passed to railways for information when desirable

evidence at Sir John Thom's judicial enquiry, the Senior Government Inspector maintained the conclusions of his report that speed was excessive, the engine was hunting, and the track, though sufficiently strong for normal traffic was unable to withstand the strain of the "XB" engine running at over 45 m.p.h. and hunting. The railway authorities maintained that speed was not excessive, that the hunting was insufficient to distort track of normal strength; also that the track at this point was not only weak but had previously been distorted by two other fast trains passing over it a few hours earlier. Other salient facts are that in April, 1934, the railway authorities decided to impose a speed limit of 45 m.p.h. on "XB" class engines when running over 88½-lb. track during each monsoon period; it was during one of these periods that the accident occurred. Also, the driver of one of the previous fast trains—drawn by a 4-6-0 type locomotive—had reported a serious lurch near this point, but the traffic control office had failed to have a caution order issued.

The report upon the judicial enquiry found that the derailment resulted from distortion of the track, caused by "XB" class engine No. 1916 running at excessive speed and hunting, and that the accident was attributable to negligence by the railway, which was consequently liable for damages. The judge supported this finding by stating that the traffic control was guilty of negligence due to failing to have a caution order issued, and that the Operating Department was guilty of negligence in that an "XB" engine was allotted to a link which, due to the speeds entailed, was unsuitable for this type of engine. (No non-"XB" was available at the shed concerned to work this link owing to an abnormal number of 4-6-0's being laid up for repairs, and it was because of this that "XB" 1916, a spare engine, was utilised.) The judge further considered it his duty to recommend that "the design, purchase and continued purchase" of the "X.B." class of engine should be the subject of a thorough, searching, and independent enquiry, as it was clear from the evidence that these engines, even with modifications designed to improve their running, were far from satisfactory, and had been a source of danger to the public since their introduction into India in 1928. It was this recommendation that led to the appointment of the Indian Pacific Locomotive Committee whose enquiry was begun in India on September 1. The essential points of the judicial enquiry report were discussed in a leader in our issue of April 29 last. Dimensions, a line drawing, and other information concerning the "XB" type of locomotive, and details of the permanent way at and near the point of derailment, were published in THE RAILWAY GAZETTE of May 20. There are three Indian standard classes of Pacific locomotive, large numbers of which have been running on various railways for about 10 years, the light "XA," medium "XB," and heavy "XC."

was the most serious calamity ever experienced by the railway. The outbreak occurred on a fast train at Mile 74 on the Chinese section, and the train being filled to capacity, the loss of life was heavy, amounting to 84, and in addition 30 were injured. The origin of the fire could not be discovered but arson was suspected; photographs are reproduced in our present issue, at page 462. As a consequence of this fire it was decided to extend existing safety precautions, and coaches were fitted with glass-covered brake-cocks instead of the chain type of alarm signal, and sliding instead of hinged doors.

The year opened with good prospects for traffic and indications of improvement in trade. The comparisons of revenue are, however, vitiated by the effects on traffic, from August onwards, of the Sino-Japanese conflict, and also by the closing of Shum Chun Casino, and the cessation of express train haulage—now normally in the hands of the Chinese section administration—which resulted in a loss of earnings, as compared with 1936, of approximately \$193,000. On the other hand the activities of the railway have been considerably extended by the connection to the Hankow line, leading to an increase in goods traffic, and the diversion to Hong Kong of traffic previously consigned to Shanghai. Operating results compare as follow:—

| | 1937 | 1936 |
|------------------------------------|-----------|-----------|
| Mileage open | 22 | 22 |
| Passengers | 2,721,518 | 2,823,867 |
| Goods, tons | 185,839 | 78,721 |
| Operating ratio, per cent. | 67.18 | 63.49 |
| | \$ | \$ |
| Passenger receipts | 923,624 | 989,786 |
| Goods receipts | 185,263 | 58,538 |
| Gross receipts | 1,331,468 | 1,245,469 |
| Operating expenses | 894,533 | 790,736 |
| Net receipts | 436,935 | 454,733 |

The most noteworthy event of the year was the construction and opening of the connecting loop, mentioned above, 9 miles in length, providing through running between the Canton-Hankow and the Canton-Kowloon Railways. Record numbers of through passengers were carried during both the Ching Ming festival and the Coronation celebrations in May. The most pleasing result, however, was the unexpected rise in through goods receipts. Co-operation with the river steamboat companies continued, and the basic fares were maintained. The Canton Belle, the second streamlined parlour railcar, was placed in service in May. This car, like its sister car the Taipo Belle, became extremely popular. An air-conditioned lounge car of the ice-activated type was constructed in the railway workshops and placed on the Canton run in June. This car, called the Aurora was the first of its kind in China. Experience gained with wheel treads turned to an angle of 1 in 20 and rails laid to 1 in 40 shows that the life of tyres is lengthened considerably, although there appears to be a liability to wheel slip on curves with maximum loads. Extensive damage to the track, estimated at \$80,883, was caused by a typhoon of record intensity which hit Hong Kong on September 2, when over a mile of line was washed out by a tidal wave, causing a total suspension of all traffic during ten days. Air raids on the Chinese section were responsible for other suspensions amounting to 7½ days. The outlook for the coming year is obscure, due to the shadow cast by the hostilities in China. With peaceful conditions, however, financial prospects would be more encouraging than at any time in the history of the railway. Towards the latter part of the year, considerable work was undertaken for the Canton-Hankow Railway. Three first class sleeping cars were erected, one tender class locomotive was reconditioned, and four 30-ton wagons were rebuilt. In addition, work is proceeding on one locomotive and three wagons. The motor repair shop was kept fully employed during the year.

Kowloon-Canton Railway (British Section) in 1937

THE working of the Kowloon—Canton Railway (British Section) was affected in 1937, according to the annual report we have received from the Manager and Chief Engineer, Mr. R. D. Walker, by a series of vicissitudes which made it the most eventful period in the history of the railway. A disastrous fire in January was followed by a major derailment ten days later, a record typhoon in September, and lastly the intensive bombing of the Chinese section of the line from October to December, which caused damage to rolling stock and the cancellation of certain through trains. The fire on January 16

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Timetables

London, August 28

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—Your editorial article on "Timetables" (page 316 of your issue of August 19) appears to hold out some hope that the "all-railway type of timetable," so badly needed in Great Britain, may—if it ever appears—not be in the present form of *Bradshaw's Guide*. But ever since the war, when the pages of *Bradshaw* were used by several railways to supersede (temporarily) their own timetable issue, the use of *Bradshaw* as the official public timetable for all railways has, I believe, been constantly under consideration, and *Bradshaw's* main-line tables are now mainly in conformity with the groups' timetables, with—we may reasonably suppose—this object in view. The shortcomings of *Bradshaw* are, therefore, a very proper matter for criticism at the present time, for the issue of timetable books by each railway (or group) has never been a paying proposition, and now that (in order to reduce printing costs) main-line alterations have to be settled so long in advance that the supply of transport cannot always be regulated, at short notice, to the demand, an official *monthly* timetable issue has obvious advantages.

The defects of *Bradshaw* arise from two causes—too many "notes," and too many "connections" to burden the main-line tables. Your article deals with the question of "notes"; many of them are quite unnecessary, and are often hidden in the binding of the book. *Bradshaw*, in this respect, has actually beaten the railway companies by coining some "notes" of his own, and is so proud of the TC ("Through Carriage") note that it is actually inserted over trains which have no ramifications beyond their main departure and arrival points!

The "connections" are a much more serious matter, for they add pages to the volume which might be used for clearer presentation of local services or for separate "Saturdays Only" main-line pages in summer, where *Bradshaw* does not yet copy one of the best points of the groups' books. The "model" in this matter is undoubtedly the old North Eastern Railway book, which gave, on each sectional table, very few "outside" points other than the starting and destination stations of the long-distance trains, yet on *Bradshaw's* pages 412 and 413 for example (the L.M.S.R. Euston—Crewe main-line) we find, against some 40 stations actually on the line of route, about 60 beyond its limits! If a passenger wants to find his way from Luton (L.N.E.R.) to Huddersfield or from Leicester to Llandudno, he cannot expect to find it on the Euston—Crewe main-line tables, and all the stations included outside this section of main-line should be those which must appear to demonstrate the actual starting and arrival point of each train. Some summary tables could even be included with less labour and space than the present arrangement demands.

In their sectionising of the main-lines, and in the display of local and suburban services (which it is fair to remember are not always included in the groups' sixpenny books) the compilers have sacrificed clearness and simplicity to some very ingenious "compressions"—due, as you very fairly state, to the sad fact that the compiler of a timetable rarely uses it himself—which have at long last justified some of the old "Punch" jokes. Apart from the High Barnet example you quote, I defy anyone to master the Waterloo and Guildford (*via* Claygate) local service on pages 194-6; and the sectionising of the G.N. (Ireland) main-line on pages 1110-1 and 1117 is a very bad case. Yet these devices are not really necessary as space-savers, for elsewhere—the G.W.R. Swindon—Fishguard (page 64), or the Waterloo and West of England (page 170) tables, for instance—we find large areas of empty columns due to the inclusion on one table of sparsely-served and busy districts. Compare page 171 with 439b, and I think the need for some re-arrangement will be obvious.

It is admitted, of course, that the compilers of *Bradshaw* have had peculiar difficulties of late. The "Saturdays only" arrangements for main-line services in summer, and the inclusion as "ordinary trains" of many of the Sunday half-day excursions, called for special treatment, and the railway practice of making minor alterations during the currency of a timetable often makes the next issue of *Bradshaw* out of date when it appears. But this does not explain the various pitfalls and difficulties now to be found in *Bradshaw*, which are most noticeable in the vital July and October issues of the guide. Many of the older generation of railwayists regard *Bradshaw*, I believe, with feelings of real affection, and would be only too willing, as your article suggests, to give its compilers whatever advantages their experience, as timetable users, may possess.

Yours, &c.,
VIATOR

86, Woodstock Road,
Bedford Park,
Chiswick, W.4
August 22

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—I was particularly interested in the editorial on timetables on page 316 of your August 19 issue, and heartily agree with you on the necessity for simplifying and standardising the four railway companies' timetables. I also think, with this point in view, a little more co-operation between the traffic side and the public timetable department would obviate cases like the following. On Saturday mornings in the current L.N.E.R. timetable the departures from King's Cross are as follow:—

| | |
|------------------------|----------------------------------|
| July 16 to September 3 | July 9, 10, 17, and September 24 |
| 10.00 Edinburgh. | 10.00 Edinburgh. |
| 10.05 Glasgow. | 10.05 Glasgow. |
| 10.10 Edinburgh. | 10.10 Newcastle (July 9 |
| 10.15 Newcastle. | and September 10 only). |
| 10.21 Harrogate. | 10.15 Harrogate. |
| 10.28 Hull. | 10.21 Hull. |

Now, is it really necessary that on the four Saturdays, July 9, 10, 17, and September 24, the 10.21 Harrogate and 10.28 Hull trains should be advanced 6 and 7 min. respectively, with a consequent series of notes not only in the main-line table but in every table where connection is shown with these trains?

Regarding the London and South Coast table in the Southern book, the inclusion of the Bognor and Portsmouth trains *via* Horsham, with the Brighton main-line trains, apart from the space wasted, makes the table unwieldy and also necessitates extending it over two pages. This, combined with the minuteness of the type used, requires great care when reading to avoid mistakes being made through columns on the lower page being out of alignment with those on the upper. Trains such as the 18 min. past the hour from Victoria *via* Horsham show, apart from the London Bridge connection, no further times until the lower page is reached, and with the columns out of line, one can very easily read into the wrong column.

With the next issue of the L.M.S.R. timetable, I presume the relief trains running on the Western Division main line, chiefly on Christmas Eve and the Thursday before Easter, will again be shown. This, whilst a good idea in itself, enabling the railway company to space the traffic out and also giving the prospective traveller some idea of what train to look for before he arrives at the station, leads to a certain amount of annoyance when referring to this table at other times. Would it not be possible to show these relief trains all together at the end of the table, headed "Relief Trains" and with a heavy border or other distinctive marking, or in a small separate table?

A further point, and one that has often puzzled me, is the necessity for so many differences between the public and working times of trains, in many cases for no apparent

reason. In no other country that I know of does this take place. For instance, why should the 7.10 a.m. Weston-super-Mare to Paddington on the G.W.R. be shown publicly to arrive Paddington 10.0 a.m. when the working time is 9.57; or again, why show the 5.0 p.m. London Bridge to Brighton on the Southern Railway arriving 6.0 p.m. when it is really due at 5.56. On the latter train, probably 80 per cent. of the passengers are daily users who very soon become aware of its correct arrival time.

Finally, a legible and simplified timetable of a convenient size, common to all four railways, would not only be a boon to all timetable users, including the inquiry office staffs, but would help to remove the horror with which railway timetables are looked upon by the general public with a resultant gain to the companies themselves.

Yours faithfully,

L. BUROW

PUBLICATIONS RECEIVED

String-Lining of Railway Curves.

By P. E. Knight, B.Sc., A.C.G.I. London: THE RAILWAY GAZETTE, 33, Tottenham Street, Westminster, S.W.1. 8½ in. × 5½ in. 117 pp. Illus., with diagrams. Price 7s. 6d. net.—The cry today is for greater speed. On railway curves increase of speed means increase in the forces acting on the track tending to push it out of line. The necessity, therefore, of economical methods by which the track can be easily put to true alignment is self-evident. The subject, "String-lining of Railway Curves" has long needed a text-book explaining in simple language the principles involved and the method of carrying out the various operations in truing up a curve. Mr. Knight's book fulfils this need with a lucidity that the practical railwayman will quickly appreciate. As Mr. George Ellison, Chief Engineer of the Southern Railway, remarks in a Foreword: "The principles involved and the simplicity of their application are very clearly explained, and I wish the book every success."

The work deals with the arithmetical method of string-lining, and details a simple method by which the required amount of slue can be easily obtained from the versines of the curve to be dealt with. Examples of simple, reverse, and transition or spiral curves are given, and the factors covering the length of the latter are specially considered.

The design is described of a special gauge for fixing the setting out pegs in the four-foot way after the necessary slue has been obtained. This simplifies the work on the ground and saves computing the distance from the running edge of the rail to the setting-out peg. One chapter deals fully with the mathematics of the spiral and the development of constants for checking purposes, a table of constants being given from various stations' distances. A further chapter deals with various series of numbers which represent the versines at each station on a true spiral curve, showing also how the series alters when the tangent of the spiral is half-way between the stations or at other positions. Tables are included for series, progressing in tenths, where the tangent is situated at any point between the first station or station +0.9; these are designed for use with the slide rule and give a choice of over 800 different spirals for each radius of the circular curve. Mr. Knight does not advocate fixing permanent monuments, owing to the possibility of movement taking place

due to frost or creeping of made ground. This may be a debatable point, but, as the author points out, a lying monument is worse than useless.

The work is one that can be recommended to all permanent way men whether at home or abroad, as it imparts simply and lucidly the necessary information that will enable realignment to be carried out by the use of simple arithmetic only. The chapters dealing with the mathematical side of the subject will appeal specially to the technical man and, with the use of the tables, enable him to obtain easily the solution of any problem. The book is well printed and the diagrammatic illustrations models of clarity. It is stoutly produced and of just the size to slip into the pocket. A full table of contents serves as a sufficient index.

Die Filme der Verkehrswissenschaft (Films Illustrative of the Science of Transport).

Berlin: Published by the Film Department of the German State Railway (*Reichsbahnfilmstelle*), 76, Hallesches Ufer, S.W.11. 8½ in. × 5½ in. 214 pp. 17 illustrations. No price stated.—About 13 years ago the Reichsbahn Film Department was established, with the object of building up a collection of films, speaking and silent, touching every aspect of railway work, for research, instructional and commercial advertising purposes; the present catalogue shows the remarkable progress that has been achieved, to some extent in conjunction with other railway administrations. In recent years also the activities of the department have been enlarged to cover Post Office work, the motor roads, inland waterways, shipping, and civil aviation, so that a list of about 600 films is now available. Some of the most interesting of the railway films were shown in London in November last, as recorded in our issue of November 26, 1937, and at the Paris Exhibition of 1937 two Reichsbahn films on high-speed locomotives and the new north-south line in Berlin gained gold medals; a bronze medal was awarded to another illustrating the testing of materials.

The present volume gives a short description of the films available to the public, with the conditions governing their loan and use, whether for educational or entertainment purposes, and the titles of a number of others in possession of the department and issued only for special purposes, chiefly staff

training, or the study of technical processes and research. These latter films are not available for ordinary public lectures.

A glance over the titles of the films shows that every side of railway working has been carefully covered, both from the engineering and operating aspect. The construction of locomotives, rolling stock and other equipment, permanent way, signals, telegraphs, bridges and tunnels, shunting yards, all find the fullest treatment, and there are many films showing the scenery passed through on every part of the Reichsbahn. An exchange of films takes place with several foreign lines, and films in English, French and Italian are available, dealing with railway work in several countries, while some of the Reichsbahn films, which are now being sent all over the world, have had the text arranged to be spoken in other languages. The list is classified and any desired subject can be very easily found. The volume will certainly fulfil the hopes expressed in the preface, and prove most useful to those who may contemplate applying to use the films.

New Signalling Installations.—

The Westinghouse Brake & Signal Co. Ltd. has issued two illustrated booklets describing the long distance double-wire control of points at Johnston, G.W.R., and the colour-light signalling on the L.N.E.R. Chingford branch. Both are reprinted from articles in THE RAILWAY GAZETTE. The Johnston installation (described in our issue of October 29, 1937), involved the concentration in one box of the control both of the station and the actual junction of the Neyland and Milford Haven lines. Eight double-wire levers are provided for working points at distances between 340 yd. and 730 yd. from the box. General views (including a diagram) and detailed illustrations of the equipment are reproduced from our pages.

The L.N.E.R. colour-light signalling from Clapton to Chingford was brought into use this year, forming a continuation of that already in service between Clapton and Bethnal Green. The article, complete signalling diagram (with inset sketch map), and illustrations from our issue of April 29 this year are reproduced, together with a key map to the dates when adjacent sections of colour-light signalling were opened. Readers are referred to an earlier reprint from THE RAILWAY GAZETTE describing these sections. Examples of signalling typical of equipment throughout the colour-light area are illustrated at the end of the brochure.

THE SCRAP HEAP

Railway Journey in the Style of '88

By the courtesy of the Editor of "The Times" we are enabled to reproduce the following excellent account of the excursion to Cambridge on August 24 in the "period" Flying Scotsman train of 1888, hauled by Stirling locomotive No. 1.—Ed. R.G.

There were some railway enthusiasts who had a happy day yesterday. They travelled from King's Cross to Cambridge and back in the Flying Scotsman of 1888—a train, that is, made up of the coaches and locomotive used in 1888. In the language of the relevant L.N.E.R. leaflet, it was a "special cheap half-day trip"; and, beginning at 11.4 a.m., it ended at 8.14 p.m., which is not everybody's idea of a half-day. However, a good time was had by all, and even an inexpert observer with a detached outlook, attending the function by invitation of the railway company, felt something of the enthusiast's pleasure in this trip.

It was announced that the engine and coaches would be available for inspection after the arrival at Cambridge, but no one was going to miss the chance of a preliminary inspection at King's Cross before the departure. Passengers crowded the platform alongside the locomotive and looked with admiration at the old warrior brought back to life. For the Flying Scotsman of 1888 was in fact a warrior, fighting repeated attacks on its speed record—and always winning the fight. Many of the enthusiasts were not ashamed to be seen wiping tears from their eyes as they gazed at this veteran Flying Scotsman yesterday.

A picturesque touch was added to the scene by a group of men and women arriving in Victorian dress. Some of the dresses might have done quite as well if the departure from King's Cross were to have been by stage-coach, but 1888 as measured in railway history perhaps seems farther back in time than 50 years ago. As for the train itself, it looked spick and span in a new coat of varnish, and inside the coaches had been repainted. The coat-of-arms of the E.C.J.S., the East Coast Joint Services, made a dignified and impressive embellishment on the sides of the coaches.

The departure from King's Cross was suitably cheered by a crowd on the platform and by a group of people looking down from a bridge above. From then onwards this trip was a matter of genuine enjoyment to the railway enthusiasts only. They got their notebooks out and jotted down "King's Cross, 0.00." At intervals some other place and some other figure was jotted down. Crossword puzzles and the other normal pastimes associated with railway travel were entirely absent from this strange journey. Cameras were used with the utmost vigour and for the strangest purposes. There were people who deliberately took photographs of

the mouth of each tunnel that the train entered.

And in each tunnel the train was in darkness. There was, however, gas-light apparatus in each compartment, and it might have been thought that there were no mantles until an enthusiast explained that there were no fish-tails. The train was spoken of in terms of affection. "Now she's pulling," someone would say with an emotional disregard for the sex of the Flying Scotsman and his locomotive, which is technically known as Patrick Stirling No. 1. Occasionally groups of people along the line cheered the train on its way, and several enthusiasts commiserated with each other at not being able to watch the train from outside (and photograph it) as well as travel inside it.

Someone suggested that "we had not touched 50 yet." Instantly watches were produced, and by a process of looking out of the window and then working out some figures in the notebook it was calculated that the train was travelling at 45 miles an hour. In the green fields the cows seemed unconcerned, but at Welwyn Garden City—one of the stations that never knew Patrick Stirling, an enthusiast observed—people gathered to watch the Flying Scotsman's progress. Then at Hitchin the train stopped for five minutes.

These were five minutes not to be wasted; to have had a coffee at the refreshment buffet would have been sacrilege or lunacy. That was not why the train had stopped. It had stopped to let the Queen of Scots pass. Cameras were focused on every possible aspect of the scene and photographs were taken of the front, the back, and the side of the old Flying Scotsman with and without the Queen of Scots passing and about to pass. Then Hitchin was left behind to a chorus of cheers as the train pulled out; and in some notebooks it shared the same fate as King's Cross, being marked "fig. 0.00."

Just beyond Hitchin there is quite pleasant country, and yesterday an enthusiast suddenly cried out "What a joy! Glorious!" But he had not forgotten himself; he had noted a bend in the line and had taken a photograph of the locomotive, off-side. He exchanged cards with a fellow-passenger of equal enthusiasm, and explained that his address was quite near the railway station. The other passenger explained that his own address was near the main line, between two tunnels, and that one of the tunnels is the ideal place from which to watch railway traffic on a Bank Holiday.

They noticed a motorcar in the distant landscape and wondered whether its driver realised that this was not an ordinary train. There were people standing outside a cottage close to the line and they let the Flying Scotsman pass without a wave. "Well," one

passenger explained, "they are used to it; the Royal train comes this way." The enthusiast was shocked. "Surely," he answered, "this is much more important than a Royal train."

At Cambridge the station was decorated with flags and bunting, and there were picture postcards for sale. There was also, 12 minutes later, an ordinary train leaving for London. It carried at least one passenger who had travelled in the old Flying Scotsman that morning. And it was very pleasant to be among normal people doing crossword puzzles. The pencil fumbled over a clue, and unconsciously one wrote down "Cambridge, 0.00."

WATER BY RAIL

The conveyance of Loch Katrine water 400 miles by train is an unusual freight traffic development which has recently taken place on the L.M.S.R. This water is required in London for distilling purposes; the empty casks are collected by the railway from the bonded store in London of the firm concerned, and forwarded to Buchanan Street station, Glasgow, where they are filled with water and returned. The L.M.S.R. also handles a regular "flow" of water traffic, amounting to from 60 to 80 tons a week, from Burton-on-Trent to Bolton, where it is used for brewing. A quarry at Dronfield, near Chesterfield, also receives its weekly supply of about 16 tons of water for its stationary engine by train from Cromford (Derbyshire), whilst in times of drought the L.M.S.R. carries water supplies in special tank wagons from Cromford to isolated spots on the Cromford & High Peak Section.

Some time ago we referred to the ancient goblet known as the Luck of Eden Hall, and a correspondent now points out that this relic has an association with railways far older than that with the Midland Railway Company's Settle & Carlisle line, to which we alluded. Among the early locomotives of the Lancaster & Carlisle Railway (opened in 1846) was No. 8 *Luck of Edenhall*, one of a series of 2-4-0 engines built by the Bolton firm of Rothwell & Company, which bore names associated territorially or traditionally with the district served by the Lancaster & Carlisle Railway. These names included not a few, such as *Skiddaw*, *Saddleback* (and among other classes of L. & C. locomotives, *Belted Will*, *Lang Meg*, and *Merrie Carlisle*), which were perpetuated by the London & North Western Railway (which leased the L. & C. Railway in 1859 and finally absorbed it in 1879) in successive generations of Crewe-built engines, some of these fine old names surviving into the L.M.S.R. regime. Our correspondent adds that *Luck of Edenhall* was subsequently so transferred, first to a Ramsbottom locomotive and finally to a Webb 2-4-0; the name ultimately disappeared from the L.N.W.R. list during the war years.

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

WESTERN AUSTRALIA

Westland Inauguration Ceremony

The inauguration of the new Trans-Australian express schedules, and in particular the Westland express in this State [both of which were described in our issue of July 22.—Ed. R.G.] was initiated on June 4 with a radio broadcast through the national network by the Australian Broadcasting Commission, at which the Premier of Western Australia (Hon. J. C. Willcock, M.L.A.), the Minister for Railways (Hon. F. C. L. Smith), the Commissioner of Railways (Mr. J. A. Ellis) and the driver of the first train (Mr. M. Jeffrey) participated.

The faster service and the general improvement in the facilities for the comfort of travellers on the interstate service have been very favourably received by the travelling public and will, it is thought, go far towards popularising the railway route for interstate travel from and to Western Australia.

Basic Wage Increase

On Monday, June 13, the Western Australian Arbitration Court declared the basic wage for the State for the year ending June 30, 1939. The new base rates for the metropolitan area are: males £4 a week, and females £2 3s. 2d. a week, increases of 5s. 1d. and 2s. 9d. respectively on the previously existing rates. Corresponding increases have been made in other districts. The increases apply to all employees in the railway service governed by wage or salary awards, and the estimated cost to the Railway Department as a result of the Court's decision is approximately £100,000 per annum.

Port Hedland-Marble Bar Railway

During June the annual inspection of the Port Hedland-Marble Bar line was made by the Secretary for Railways and executive officers from Perth. This section, running from Port Hedland on the north-west coast of Western Australia to Marble Bar, a distance of 114 miles inland, is not connected by rail with the main State Railway system, and is managed by an officer-in-charge with the usual running and maintenance staff. The line was originally built to serve the gold-mining interests in the Marble Bar district, but with the decline in the mining industry some years ago, the principal traffic has been to serve pastoral properties in the vicinity, and this has been insufficient to meet working expenses and interest on capital. The rainfall in this area during the past few years has been below normal, with resultant decline in traffic, but during the inspection just completed considerably better prospects were in evidence. Pastoralists who have completed shearing report very satisfactory wool clips,

in most instances equal to or better than previous records, and lambing has been good.

With the present enhanced price of gold, mining activities have also increased in the district. Prospects in this direction have stimulated business generally, and numerous new buildings are in course of erection and projected at Marble Bar, where optimism is the prevailing note. It appears likely, therefore, that if expectations are even partly realised the department may shortly have to consider augmenting the train service.

NEW ZEALAND

Excursion Train Deraiment

The derailment of a special excursion train near Ratana (North Island) on March 26, resulting in the loss of six lives, has now been reported upon by a board of enquiry. The board found that the cause of the derailment was the overturning of the engine, due to its entering a curve of 6.4-ch. radius at a speed of approximately 50 m.p.h., and that the driver's miscalculation of his speed and location when he was within 200 ft. of the point of derailment was due to an honest error of judgment, to which the presence of haze and fog contributed. The board also found that the engine and rolling stock were in first class order and condition, and that the permanent-way was well laid and maintained and perfectly safe to travel over at the authorised speeds. As this was the first accident to a New Zealand passenger train resulting in loss of life over a long period of years, the board's findings were awaited with deep interest. [This accident was reported on page 680 in our issue of April 1.—Ed. R.G.]

The Question of All-steel Coaches

As a result of numerous communications addressed to the board urging the use of all-steel coaching stock in the Dominion, that body requested the General Manager to submit a report upon the subject, and the following are extracts from his reply:—

... the new carriages which we are now building or have been building for a number of years, are virtually the equivalent of all-steel cars. The underframes are of steel sections welded together, which gives the effect of a one-piece unit. The ends of the cars, extending right up to the roof and over the entrance doorways, are entirely of steel, this form of construction providing a very strong and massive anti-collision end. Bodywork in between these anti-collision ends is of timber reinforced with steel and provided with steel panels. In addition we are now fitting automatic couplers, which are of very strong construction and are not easily broken as the result of a collision or derailment, as very often occurs with the standard

type of buffer which we have hitherto used.

... In mountainous countries like New Zealand it is not possible to adopt very heavy steel construction throughout the car bodies, as the effect of the increased weight of such cars would place great limitations on the number of cars which could be hauled over the various gradients; and this point is, of course, one of great importance.

While it is possible to adopt a light form of steel construction for our passenger cars which would not exceed the weight of the present construction, it is doubtful whether any benefit would be gained in the strength of the vehicle, if we take into account the very strong nature of the steel ends which are now provided, and which may have to be reduced in strength to keep the weight within present limits with the added weight included in the steel bodywork.

Extended Week-end Travel Facilities

Complete figures for week-end travel by train for the twelve months ended March 31, 1938, indicate an increase of 7 per cent. over the figures for the previous year. This marked increase proves that many more people are enjoying recreational travel during their increased hours of leisure. Following the introduction of the 40-hr. week, cheap week-end tickets, previously issuable on Saturdays, were made available for use from 3.0 p.m. on Fridays, and the policy of the department in providing these extended travel facilities has been fully justified by results, for both the public and the railways. The number of week-end tickets issued during the year exceeded 190,000.

EGYPT

New 2-6-0 Passenger Engines

The 20 new 2-6-0 locomotives [described in THE RAILWAY GAZETTE of August 26.—Ed. R.G.] have just arrived in this country. They are similar in many respects to the last consignment, but are fitted with A.C.F.I. feed-water heaters and automatic steam operation of firebox doors. They are equipped with Caprotti valve gear, and are painted green, and will be utilised for passenger duties.

New First Class Passenger Coaches

Four first class *de luxe* passenger coaches, equipped with air-conditioning apparatus, have been ordered from the Metropolitan-Cammell Carriage & Wagon Co. Ltd. of Birmingham. Each coach is to seat 36 passengers, and be of welded steel construction, the underframe and body being designed to form one complete structure. Timken roller-bearing axleboxes are to be fitted, and other features include double fixed windows, self-closing air-tight doors, and a supply of drinking water. The passenger compartments are to be panelled in two approved shades of green Rexine, the darker shade below the waist line and the lighter shade of green above that line and in the ceilings. The panels and ceilings in the entrance vestibules and attendants'

compartments are also to be covered with Rexine of a colour to harmonise with the interior decoration. The waist lines in the passenger compartments are to be covered with either suitable metallic strips or Roaboid, or Rexine strips of contrasting colour to match the colour of the table tops.

Diesel Service to Mersa Matrouh

Until September 30 a diesel railcar will continue to run from Alexandria to Mersa Matrouh on Thursdays and Saturdays, leaving Alexandria at 6.30 a.m. and arriving Mersa Matrouh at 11.20, and from Mersa Matrouh to Alexandria on Fridays and Sundays, leaving Mersa Matrouh at 16.25 and arriving Alexandria at 21.15. The distance between Alexandria and Mersa Matrouh is 311½ km.

Rapid Rise in C. & D. and Container Traffic

There has been a notable increase in popularity and in the traffic of the express collection and delivery service, and also with containers, as the following figures show :—

| Year | Receipts, £.E. | |
|---------|-----------------|-------------------|
| | Express C. & D. | Container traffic |
| 1935-36 | 357 | 1,305 |
| 1936-37 | 1,208 | 1,670 |
| 1937-38 | 2,314 | 1,948 |

Subways and Level Crossing Lights

It is understood that in view of the present need for economy, only three subways will at present be constructed under the Helwan line, namely, that now under construction between Gamé Amr and Gayara, one at Tura on account of the Prisons Department, and one at Cozzika Cabin. Traffic lights will be erected at the level crossings between Bab el Louk and El Saiyida Zenab, which will show red to road traffic on the approach of a diesel railcar.

Replacement of First Class Coaches by Pullman Cars

In its meeting on July 5, the Railway Board approved the replacement of first class coaches by Pullman cars on certain trains under the following conditions :—

(1) The International Sleeping Car Company is to allot a sufficient number of cars from the 12 now running and the recently imported air-conditioned car No. 4088, to replace first class coaches on trains Nos. 28, 29, 992 and 993 between Cairo and Alexandria for one year, after which period either of the contracting parties—the Sleeping Car Company or the State Railways administration—will be at liberty to discontinue the experiment if it so chooses.

(2) First class passengers will be allowed to use these cars without an increase of charge beyond the present supplement of roughly 2s. charged for travelling in the saloon compartments of *trains rapides*.

(3) The State Railways will receive 10 per cent. of the refreshment service earnings on these cars.

(4) The railways are to pay the company approximately 2s. for each first class passenger travelling between Cairo and Alexandria and *vice-versa* on these trains, or if the distance travelled is less than 100 km., 1s. only.

(5) According to the terms of the existing contract, the State Railways have not the right to share in the earnings of the 12 Pullman cars unless these exceed £.E. 7,000, but as these cars will now to some extent replace first class coaches, the company has agreed to reduce the minimum to £.E. 5,500, and if the earnings exceed this sum, the railways will share to the extent of 10 per cent. of the total amount taken.

(6) The State Railways will recommend that Customs fees on Pullman car No. 4088 be charged according to the old rate instead of the new regulation, namely, on the price quoted in the bill and not according to weight, as this car has already been in service in Europe, and will be run here on trial for one year.

INDIA

Regirdering of Dufferin Bridge

The Railway Board is understood to be considering a project for the replacement of the girders of the Dufferin Bridge near Moghalsarai, on the East Indian Railway, and the separation of the road and railway tracks by cantilevering the former out at each side of the main girders. The estimated cost of the scheme is about Rs. 60 lakhs (£450,000), one-third of which will be met by the United Provinces Government on account of the road charges. Provision will probably be made in the 1939-40 budget, but the work will be spread over two or three years. The bridge was built in 1887.

Railway Bridges Washed Away

Quite abnormal rainfall in mid-July caused spates in most of the rivers in northern and north-eastern India. In Bengal and Assam, which have suffered most, the inundation of numerous villages has not only drowned cattle and ruined crops, but has rendered homeless thousands of people many of whom have received shelter in railway trucks and on station platforms.

Two bridges were submerged on the Katihar section of the Eastern Bengal Railway and through passenger service on the Murliganj and Bihariganj branches was interrupted. Of more serious consequence was the flood of the River Aie in the Lalmonirhat district of that railway. The river cut a new course immediately north of a railway bridge between Bijni and Bongai-gaon station on the main line between Calcutta and Assam, and the great rush of water carried away the entire training works of the bridge on the left bank, also the left abutment of a 40-ft. approach span which fell into the river, and a two-storied gang-hut. This happened in the early hours of July 17, and, in spite of strenuous efforts on the part of railway staff, the breach continued to widen till it became stabilised the next day with a gap of 400 ft. east of the bridge, over which the track and the telegraph wires were left suspended. [See illustrations on page 454.—ED. R.G.] The rest of the bridge was intact but about 400 ft. of the right guide

bank was also washed away. In consequence of this breach, the booking of passengers and goods along this line was suspended, and the Calcutta—Assam mails were diverted to the river steamer route between Dhubri and Pandu.

Later Breaches in Bengal

Since the beginning of August also, almost continuous and heavy rainfall, and the consequent swelling of rivers in various parts of the country have seriously affected communications. The route to Shillong *via* Amingaon remains closed, but the alternative route *via* Dhubri and thence by steamer to Pandu Ghat is open for the transport of goods. Breaches also occurred on the Madhukhali junction—Kamarkhali Ghat section and necessitated the suspension of train service for about 24 hr. Between Chapai—Nawabganj and Amnura junction, the line was damaged by floods and through communication had to be temporarily stopped. On the Amnura—Katihar section, the track was rendered unsafe for the passage of trains between Singhabad and Rohanpur. Night running of mail and passenger trains was stopped as a precautionary measure, though passengers by day trains were transhipped.

Damage in the United Provinces

The Bengal & North Western Railway lines in the Muzaffarpur District were breached at several points, necessitating the suspension of train services. Further north in the United Provinces, breaches occurred on the main line between Maijapur and Jarwal Road stations, rendering through train service between Gonda and Lucknow temporarily impossible. On the East Indian Railway, the track subsided at several places between Unao and Bangarmau on the Unao—Madhoganj section, and, as transhipment was not possible, the operation of trains was suspended for a short period. Through communication has now been restored. Road transport in the flooded areas has also been disturbed and at some places boats have been plying on the submerged roads. Minor breaches have also occurred on other railways.

Railways in the Central Legislature

Several questions relating to railways were asked and answered in the Legislative Assembly recently. The Member for Communications stated that the majority of the railways were opposed to the abolition of first class compartments. Many, however, were examining the possibility of curtailing upper-class accommodation where local conditions justified such action.

Mr. Clow informed a questioning member that it was a matter of opinion whether the fitting of speedometers on engines would make for a greater degree of safety. The general question of fitting speed recorders was under consideration by the Railway Board.

Up to 1937, third class waiting rooms or halls for women only had been pro-

vided at 826 stations on the major railways. The policy of effecting improvements by the provision of waiting rooms for women was being followed to the fullest extent of the funds available, but the Member for Communications could not hold out any prospect of providing such waiting rooms at every station. He undertook to suggest to the railways the appointment of a woman attendant at junctions.

MEXICO

National Railways under Workers' Control

Since the operation and control of the National Railways system was formally handed over to the directorate and management nominated by the workers' unions, as described in THE RAILWAY GAZETTE of June 10 and July 1 last, radical measures of economy and retrenchment have been effected in all services. Many changes have been made, principally in the ranks of the higher executives, with corresponding reductions in the payroll. In fairness it must be said that no exceptions have been made, the General Manager himself, Sr. Salvador J. Romero, having been the first to submit to a reduction in the salary of his post, from \$7,500 a year, to \$2,000 a year. On the other hand it is observed that in many cases the changes have resulted in the appointment of persons who have distinguished themselves in their activities in the respective trade unions. But several highly paid posts have been abolished altogether, and the work of the departments concerned merged with other services. For example, the Legal and Medical Departments have both been reorganised, with a very appreciable saving in expense.

The presidential Decree of June 23, 1937, expropriating the railways constituting the 8,100 miles of the National system—of which 6,855 miles are standard gauge and 1,276 of 3-ft gauge—confided the administration to the Government Railway Department. The later law, authorising the control to be handed over to the workers, lays down certain conditions. The governing body is to consist of seven members, nominated by the unions. These directors are to serve for two years, but may be re-elected. Two controllers are appointed by the Ministry of Finance to inspect and audit the railway accounts. The operating ratio is not to exceed 85 per cent. of the gross revenue. At least 5.36 per cent. of the gross earnings is to be earmarked for renewals and betterments, and a further percentage is payable to the Government, fixed at 5.64 per cent. of the gross income when this exceeds \$125,000,000 a year, or 3.64 per cent. if under that figure. The board of directors is responsible for the administration of the system and for the disposal of all revenues, subject to the veto of the Ministry of Finance. The authorisation of the Government is, however, necessary for any new capital

works, and for the abandonment or closure of lines, or disposal of property. Any increase of tariffs is also subject to Government approval. The railway system continues to be subject to the national taxation, and the employees continue to enjoy the same legal rights as such, as they had under their previous employers. At the moment the question occupying most attention is that of the proposed increase in tariffs. A booklet has been published by the railway administration showing that the traffic of the mining industry has been unduly favoured in the past by unremunerative rates, the effect having been that other traffic has been overcharged while the railways have been operated at a loss. It is said that President Cardenas is not in favour of the increase in tariffs, but the administration is making out a strong case, and is backed by the unions.

UNITED STATES

Wage Discussions Continue

The National Mediation Board has, unfortunately, failed up to now to achieve a settlement of the dispute between the unions and the railway managements, arising from the demand of the latter that wage rates be reduced by 15 per cent. The unions so far have been adamant in their refusal to accept any reduction whatsoever, being fortified in that attitude by the fact that a National Election for Members of Congress comes in November; and believing, apparently, that the National Government will be desirous of their votes and, hence, that it will support them in any position they care to take at the present time. The companies announce that the reduction will be put into effect on October 1, and the unions are preparing for a national strike ballot.

Railway employment in June this year totalled 935,000, a reduction of 260,000 during the past year. The unions, however, have shown no concern whatsoever at the decline in employment of their members—trusting to the Government's generous unemployment relief measures to care for them—and are devoting all their efforts to the maintenance of present wage rates, which are the highest in history.

Eastern Fares Rise

The Eastern railways were permitted by the Interstate Commerce Commission to advance their passenger fares (in coaches) at the end of July from 1d. to 1½d. per mile. The Commission granted the authority with some reluctance, in view of the fact that the rate remains 1d. or less in other sections of the country; and further, because, in the opinion of some of the Commissioners, the railways will garner more revenues at 1d. than at the higher rate. Nevertheless, the regulatory body was of opinion that the railways were entitled to make the experiment with

the higher fares, since their need for greater revenues was admitted.

SOUTH AFRICA

Railway Budget for 1938-39

A railway surplus of £5,033,489 was budgeted for by the Minister of Railways, in presenting his proposals to Parliament. He recalled that when he presented the Part Appropriation Bill at the beginning of the year, he anticipated a surplus of £1,000,000 at the end of the financial year, and foreshadowed fare reductions to an annual amount of £500,000. At that time these anticipations were well founded, but during the three months January-March, 1938, revenue decreased to such an extent that the expected surplus of £1,000,000 was reduced to one of £320,769. During the succeeding four months the short-fall in revenue continued and accumulated to a total of approximately £435,000, thus eliminating all possibility of carrying into effect the anticipated fare reductions.

For the current financial year the revenue was estimated as under: Railways, £36,415,861; Harbours, £2,057,600; Steamships, £151,295; Airways, £15,225; Total, £38,776,981. Compared with the actual revenue for the year ended March 31 last this reflected a decrease of £456,658.

Estimated expenditure for the year 1938-39 compared with the actual expenditure for the year 1937-38 reveals an increase in the working expenditure as follows:—

| | 1937-38 | 1938-39 | Increase |
|----------------|------------|------------|----------|
| Railways ... | 31,218,147 | 31,991,743 | 773,596 |
| Harbours ... | 1,435,751 | 1,539,781 | 104,030 |
| Steamships ... | 307,302 | 414,779 | 107,477 |

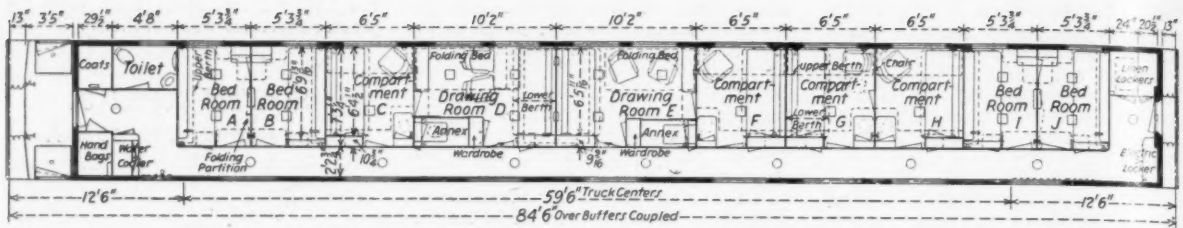
Actually, the total expected increase in expenditure by the department amounts to £988,706.

Wages accounts have been increased to the extent of approximately £210,000 to cover the cost of increased wages to railworkers and semi-skilled artisans in accordance with the recommendations of the commission appointed to investigate the conditions of service of these workers.

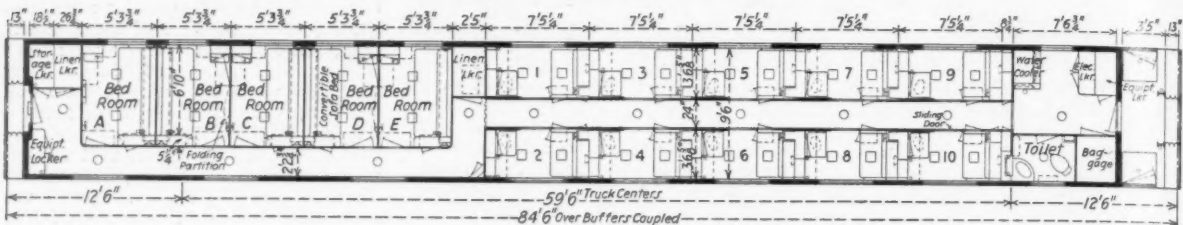
It will be seen from the above figures that after meeting working expenditure and interest on capital, it is estimated that there will be a gross surplus of £4,712,720 to which must be added the unappropriated surplus of £320,769 brought forward, making a total estimated surplus of £5,033,489 available for appropriation.

Appropriations

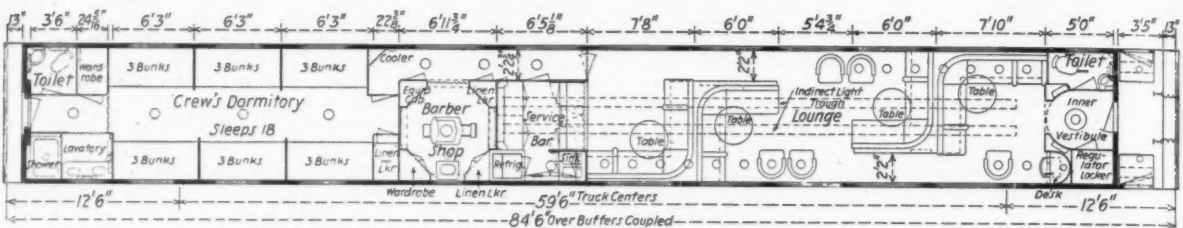
It is proposed to use the estimated surplus mentioned above, as follows: Rates Equalisation Fund, £1,000,000; Betterment Fund, £1,000,000; Renewals Fund, £1,320,769; contribution towards deficiency in Pension and Superannuation Funds, £487,000; reduction of branch line capital, £450,000; writing out of capital account, discount, and expenses on pre-Union capital, £750,000; writing off dead assets, £20,879; total, £5,028,648.



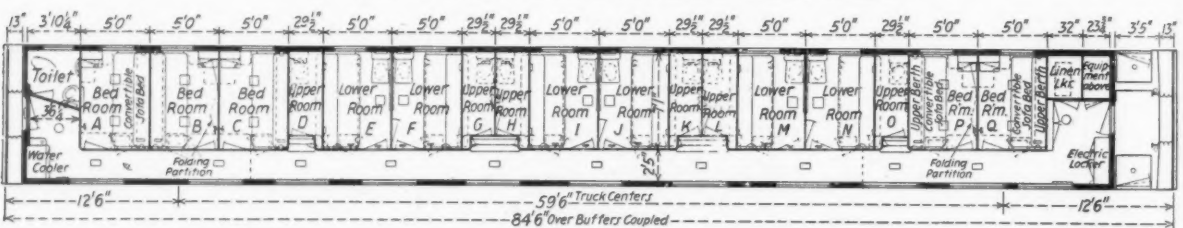
Two drawing rooms, four compartments, and four bedrooms, Broadway Limited



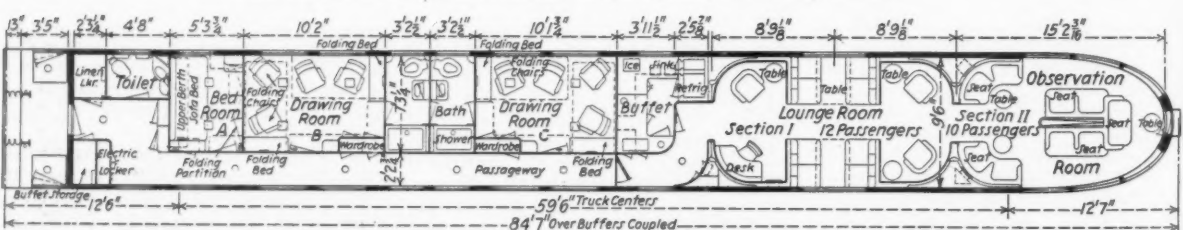
Five bedrooms and ten roomettes, Broadway Limited



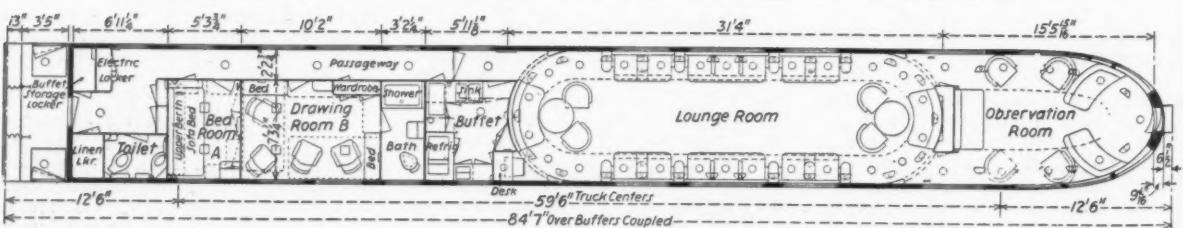
The dormitory lounge car for the Twentieth Century Limited



Five bedrooms and twelve duplex single rooms, Broadway Limited



Pennsylvania buffet observation lounge car with two master bedrooms and one bedroom



The Twentieth Century observation lounge car with master bedroom and bedroom arranged en suite

Arrangement plans of typical cars on the new streamlined Broadway and Twentieth Century Limited trains of the Pennsylvania and New York Central Railroads

THE NEW BROADWAY & TWENTIETH CENTURY LIMITED

New lightweight streamlined trains for the accelerated New York-Chicago schedules of the Pennsylvania and the New York Central

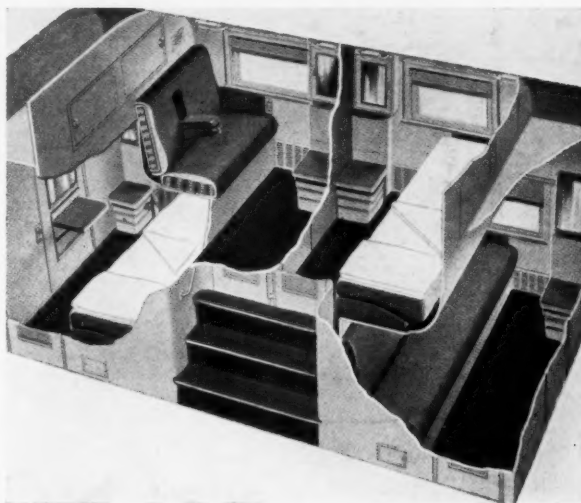
BRIEF mention was made in our issue of July 8 of these remarkable trains, which we are now able to describe more fully and to illustrate; they went into service on June 15. There are four separate trains for the New York Central Twentieth Century Limited comprising 62 new cars all built by the Pullman-Standard Car Manufacturing Co. Ltd., of Chicago. Of these vehicles, 52 are sleeping and lounge cars with separate rooms, owned and staffed by the Pullman Company, 6 are dining cars of a new type, and 4 are new mail-baggage cars.

The Pennsylvania Company has placed in service eight similar blue ribbon trains, two each for working the Broadway Limited service, two for the General (also running between New York, Philadelphia, and Chicago), two for the Liberty Limited (Washington—Baltimore—Chicago), and two for the Spirit of St. Louis (between the eastern coast and St. Louis). For these trains also there are 52 new separate-room sleepers and lounge cars—16 of them allotted to the Broadway—built, and owned and staffed by the Pullman-Standard and Pullman Companies respectively. Of the railway-owned vehicles for these trains two are new dining cars of stainless steel, built on the Shotweld system by the Edward G. Budd Manufacturing Company.

The 104 Pullman-worked Cars Described

The 52 Pullman-owned cars running on each of the two railroads are of essentially the same construction, apart from internal decoration and certain special features. For instance the Pennsylvania cars have Westinghouse brakes and Timken roller bearings, whereas the New York Central cars have the New York air brake and 30 of them have S K F and 22 Timken roller bearings. All these 104 vehicles are of high-tensile steel, welded in jigs as far as possible, and with the minimum of riveting. The exteriors are smooth throughout and have curved skirts and corrugated aluminium floor sheets with special cork filler and cork board. This insulation and the avoidance of metal-to-metal contact between moving parts at the ends of the cars, as well as general interior sound-proofing, reduces noise to a minimum. The insulation is also effective in connection with the Pullman direct-mechanical air-conditioning system installed in each vehicle.

Though aluminium alloy is used throughout the interiors,



Duplex single rooms arranged on the upstairs and downstairs principle, prepared for both day and night use. The sofa becomes a bed at night

and doors and partitions are of aluminium-covered plywood, it is the high-tensile welded steel construction of the car shells together with aluminium brake cylinders and other parts, that are mainly responsible for the new vehicles weighing little more than two-thirds the weight of the older all-steel stock of similar dimensions. Actually, as will be seen from the diagram below of the Pullman-owned stock on these trains, the total unladen car weights vary from 57 to 67½ tons, whereas the weights of corresponding conventional cars of low-carbon steel range from 77½ to 80 tons. The saving is one of from 12½ to 20½ tons a vehicle, therefore, or between 16 and 25½ per cent. As the underframes, sides, ends, and roofs of the new cars, in Cor-ten welded steel, weigh only about 12½ tons as against 27½ tons in the older cars—a saving of about 54 per cent.—there are 15 tons, out of the total 12½ to 20½ tons reduction in weight in the whole car, saved in these parts alone.

| Type of car | Baggage-mailvan | Dining car | 17 roomettes and 1 section | 2 drawing rooms and 4 compartments | 13 bedrooms | 5 bedrooms and 10 roomettes | Dormitory, barber's shop, and bar lounge | 1 drawing room 1 bedroom and buffet-observation |
|------------------|-----------------|------------|----------------------------|------------------------------------|-------------|-----------------------------|--|---|
| Weights, in tons | | | | | | | | |
| Body ... | 36.19 | 41.27 | 43.92 | 40.87 | 42.29 | 42.89 | 38.45 | 38.09 |
| Bogies ... | 26.00 | 26.29 | 19.06 | 18.64 | 18.57 | 18.86 | 18.94 | 19.08 |
| Total ... | 62.19 | 67.56 | 62.98 | 59.51 | 60.86 | 61.75 | 57.39 | 57.17 |

Diagram of Pullman-owned and worked rolling stock incorporated in the Twentieth Century (above) and Broadway Limited (right) trains, showing the distribution of the various types of car and accommodation, together with the tare weights of the car bodies, bogies, and cars complete, with empty water tanks

| Type of car | 18 roomettes | 2 drawing rooms, 4 compartments, and 4 bedrooms | 13 bedrooms | Secretary's room, barber's shop, and 2 bedrooms | 2 drawing rooms, 1 bedroom, and buffet-observation |
|------------------|--------------|---|-------------|---|--|
| Weights, in tons | | | | | |
| Body ... | 44.80 | 41.46 | 43.01 | 40.50 | 39.33 |
| Bogies ... | 18.93 | 18.47 | 18.70 | 18.75 | 18.75 |
| Total ... | 63.73 | 59.93 | 61.71 | 59.25 | 58.08 |



General views of the lightweight, welded steel, streamlined Broadway Limited of the Pennsylvania, and Twentieth Century Limited, of the New York Central Railroads

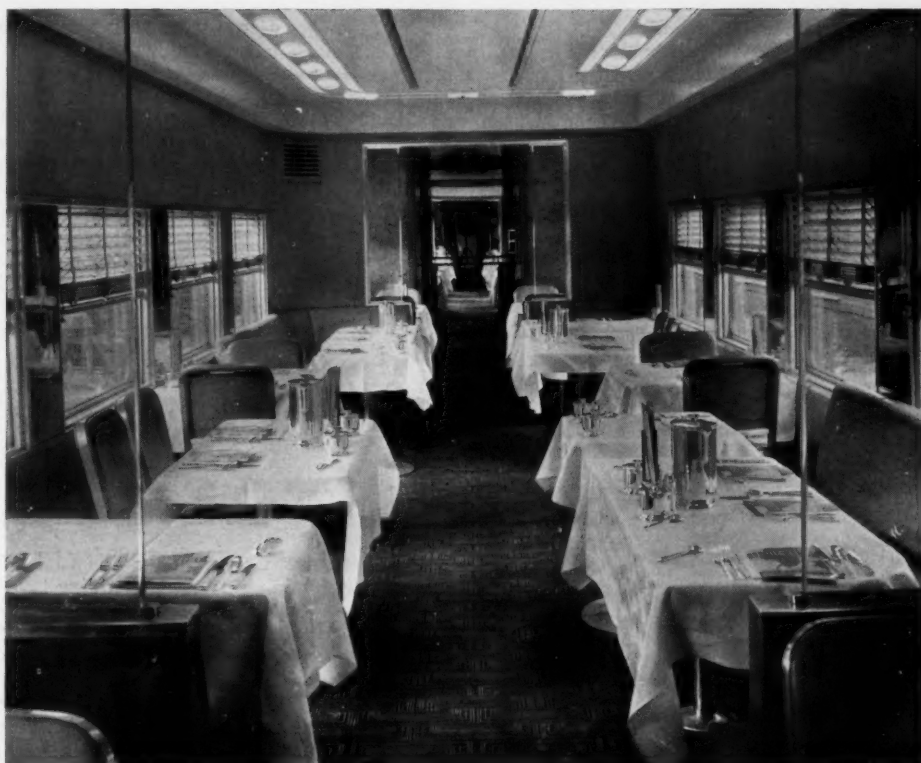


Club lounge car on the Twentieth Century Limited. The colour scheme is in rust and grey with brown cork walls and copper metal finish



Dining car on the Broadway Limited. Note the built-in sofa seats and diffused lighting. This Budd-built car is of stainless steel, and seats 44

NEW BROADWAY AND



Smart restaurant on the "Century." Tables can be arranged to suit sizes of parties. The walls are covered with grey leather and window posts are mirrored



Observation car on the "Broadway." Note the outward-facing chairs and built-in sofas. Wall coverings are of cork and leather in natural tones

TWENTIETH CENTURY TRAINS

Doubtless the more elaborate internal fittings in some of the cars weigh more than those in the older types, and also account for the varying weights of individual cars.

To eliminate starting and stopping shocks special Waughmats balanced twin-group mat draft gear is used—each group consisting of six No. 738 Spencer-Moulton rubber springs with separators—in connection with tight-lock couplers, with 9-in. diameter machined ball ends, and of annealed high-tensile steel. The connections between the cars have rubber outer and canvas inner coverings. Steps and drop doors are of the Pullman pivoted type, with trap-door operating arrangement connected in such a way as to open and close together, and fitted with an ice-breaking device. The bogies are four wheeled with nickel-cast-steel triple bolster truck frames and two brake cylinders on each.

The 104 Pullman owned and staffed cars are of the following types:—

| Type of Accommodation | Number of Cars | |
|--|----------------|------------|
| | P. RR. | N.Y.C. RR. |
| 5 bedrooms, 12 duplex single rooms | 9 | — |
| 18 roomettes | 13 | — |
| 17 roomettes, 1 open section | — | 10 |
| 2 drawing rooms, 4 comp., 4 bedrooms | 6 | 14 |
| 13 bedrooms | 4 | 8 |
| 5 bedrooms, 10 roomettes | 2 | 12 |
| 1 dormitory, barber's shop, service bar and lounge | — | 4 |
| 2 bedrooms, secretary's room, barber's shop, bar lounge | 2 | — |
| 3 bedrooms, 1 drawing room and bar lounge | 9 | — |
| 1 deluxe drawing room-bedroom, buffet lounge-observation | — | 4 |
| 2 drawing rooms, 1 bedroom and buffet lounge-observation | 4 | — |
| 2 drawing rooms, 1 compartment, 1 bedroom, buffet lounge-observation | 3 | — |
| | 52 | 52 |

The Twentieth Century trains are made up of from 13 to 16 cars, and—as stated in our issue of July 8—the inaugural trial Broadway train consisted of 13 vehicles, but was without the mail-baggage car included in the standard make-up of this train. There are 16 of the new Pullman-owned cars in the two Broadway compositions; and the dining cars, apart from the two Budd-built stainless-steel vehicles mentioned above, have been rebuilt and entirely refitted in the Pennsylvania workshops.

The accompanying diagrams and photographic illustrations show the principal features of the internal arrangements of this rolling stock. It will be noticed that the accommodation provided resembles closely that of the City of Los Angeles trains described and illustrated in our issue of August 27, 1937. In particular, the roomette and drawing room types of convertible day and night rooms were then depicted and described. The "upstairs and downstairs" duplex pattern of single bedroom, which becomes a lounge by day, was also briefly described. As, however, it is of particular interest, we illustrate the general arrangement of a group of four of these rooms, each with its own toilet facilities and individual regulation of heating and lighting.

On the Broadway some of the downstairs duplex rooms are *en suite*, a sliding partition enabling two to be thrown open as one. Some of the upper rooms also have communicating doors. It will be noticed that none of the cars forming these new Eastern lines trains are articulated as are some of those on the Pacific run.

We are indebted primarily to our American contemporary the *Railway Age* for the diagrams reproduced and bulk of the information published above, also to Mr. C. W. Y. Currie, Publicity Manager, New York Central System, and Thomas Cook & Son Ltd., London, Agents of the Pennsylvania Railroad, for the photographic illustrations and other information, and to the Pullman-Standard Car Manufacturing Company for additional details of weights and the diagram of the new Pullman-owned cars in each train.

Washed out land span and approach to the Aie river bridge, on the metre gauge section of the Eastern Bengal Railway from Calcutta to Assam. Right: track hanging in a festoon across the new course of the river. Below: the main spans of the bridge intact, but the breach and unsupported track can be seen to the left



For description see Overseas paragraph on page 448

POWER SIGNALLING IN BRAZIL

Modern apparatus installed in connection with electrification of the Central Railway

A COMPLETE power and automatic signal system was installed on the Central Railway of Brazil concurrently with the electrification of its lines round Rio de Janeiro. The first stage of this electrification, described in our *Electric Railway Traction Supplement* for March 4, 1938, comprises the suburban section from Dom Pedro II to Deodoro, the main line thence to Nova Iguaçu, and a part of the Santa Cruz branch from Deodoro to Bangu. The original signalling was mechanical, except for electric power signal boxes at S. Diogo and Cascadura, with manual block working; automatic G.R.S. type SA searchlight colour-light signals and train stops have now been installed to provide a headway of 3 min. Power signal boxes have been provided at Dom Pedro II (184 levers), Engenho de Dentro (56 levers), Cascadura-Madureira (48 levers), and Deodoro (120 levers), and eight new electro-mechanical installations, comprising in all 316 levers.

The newly signalled section comprises 12 km. (7.45 miles) of 4 track line from Dom Pedro II to Engenho de Dentro, 5 km. (3.10 miles) of 6 track line thence to Madureira, with 4 tracks again onwards to Deodoro, a distance of 6 km. (3.73 miles). From Deodoro to Novo Iguaçu and Bangu the line is double.

In general, three-aspect running indications are given with full block overlap, requiring two blocks ahead clear before the red aspect in a signal can change; diverging movements at interlockings are authorised by red over



Running and shunt colour-light signals on poles at Engenho de Dentro

yellow, the yellow light being shown from an additional unit, normally dark, fitted below the main signal. Clearances being restricted, the majority of running signals are mounted on the catenary structures, but where space permits pole mounted signals are used.

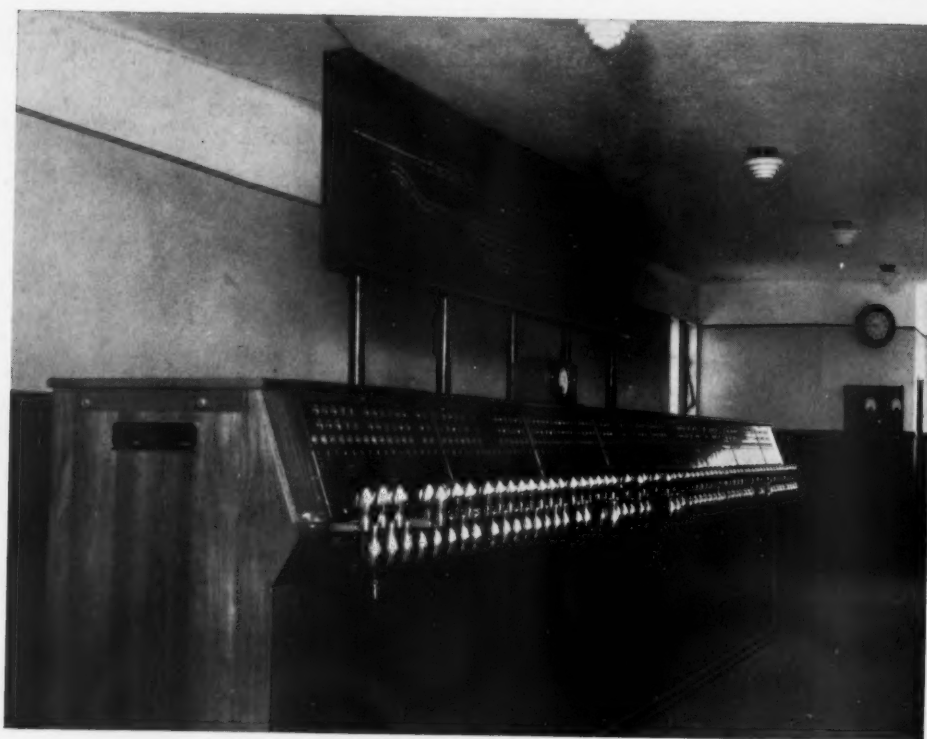
Two aspect (red and yellow) colour-light dwarf signals are used as shunt signals at power interlockings, with mechanically operated disc type signals at electro-mechanical boxes; in general shunt signals are ground mounted. Number plates on the running signal backgrounds indicate the location in kilometres to the nearest 100 m., and the number of the track to which the signal applies. A letter "P" indicates when the signal is permissive. Track circuits in automatic signal areas are double-rail a.c. with impedance bonds, resistance fed, but within interlocked areas the single rail type is used, condenser fed, with a 20 mfd. condenser in the secondary of the track feed transformer. A shielding unit protects the track relay coil from d.c. flowing from the traction return rail through the track circuit apparatus, as with a high leakage current overheating and bad operation of the relay due to magnetic saturation might result. Track circuit equipment is housed in welded steel cases.

Power Interlockings

All-electric signal boxes have G.R.S. type "D" locking frames, all locking being accomplished electrically. Controlled signals are indicated above the respective levers



Relay equipment in Deodoro signal box



All-electric interlocking frame in Deodoro signal box



Electro-mechanical locking frame and apparatus in Derby club signal box

by red and yellow, and the points by N and R indications. A lock free indication is also provided for each lever.

Points are worked by G.R.S. model 5A machines from 110-volt trickle-charged batteries, using the G.R.S. superimposed point detection circuit, in which a.c. detection is superimposed on the d.c. operating wires. No separate detection wires are thus required and the operating circuit is constantly and automatically checked, as well as the correspondence between lever and function, a further advantage, eliminating a considerable amount of wiring in the signal box. Point detection relays are Model 2, Form A, three-position, with six N and six R contacts.

Illuminated diagrams are of the steel plate, spotlight type, with track circuits normally dark. Apparatus in relay rooms is carried on hard-wood shelves, made of local timber and mounted on steel relay racks. In the illustration of the relay room at Deodoro signal box are seen, reading from top to bottom, the indication transformers, d.c. relays for approach locking releases, types L vane relays, and type L track relays with shielding units. On the lowest shelf are seen Model 2, Form A, 3-position point detection relays.

Electro-Mechanical Interlockings

At electro-mechanical interlockings the points and shunt signals are mechanically operated, with electric detection on facing points only. Colour-light signals are operated from mechanical levers by circuit breakers and lever locks and, with the electrically detected points, indicated in the signal box by individual indicators let into the shelf on which the illuminated diagram is supported. Hand

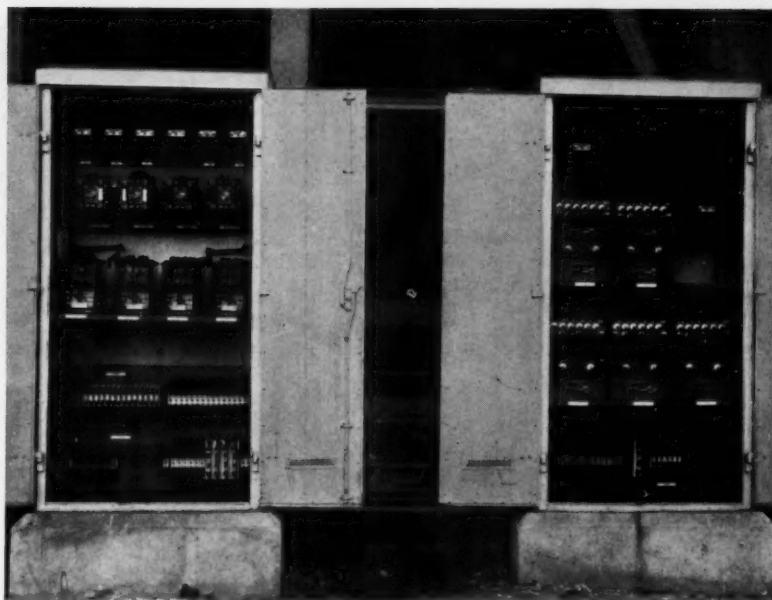
operated sealed push-button releases are used for approach locks. A king lever is provided to close a signal box when required.

Power Supply

Power is supplied from a 4,400-volt single-phase line carried on the vertical supports of the catenary structures, on which line transformers, with the necessary switchgear, are mounted where required to step voltage down to 110 volts for signal purposes. All control cables are Ancalite insulated, single core, finished with weatherproof compound.

The work of installation was carried out by the General Railway Signal Co. Ltd., London, and the equipment was brought into service in sections in accordance with the electrification programme, under the direction of Dr. Benjamin do Monte, Electrical Engineer, subject to the approval of Dr. Rubem Vaz Toller, in charge of signalling.

ANOTHER EXCURSION BY 1888 FLYING SCOTSMAN.—On Sunday next, September 11, a private party of 170 railway enthusiasts and their friends will leave King's Cross at 1.15 p.m. in a special excursion train for Peterborough. These railway enthusiasts have chartered from the L.N.E.R. the 1888 Flying Scotsman train and locomotive for this outing and arrangements have been made by the railway company for them to obtain photographs of the veteran at intermediate points *en route*. The general public will be able to see the old train and locomotive on Wednesday and Thursday, September 14 and 15, when it will be on exhibition at Alexandra Palace station.



Track circuit apparatus in steel location cases at Cascadura



Interlocking area at Engenho de Dentro, showing point machines



The rebuilt box in operation 13 days after the fire



The new lever frame set up during rebuilding work
RECONSTRUCTION OF BROMLEY NORTH SIGNAL BOX, SOUTHERN RAILWAY



The old box, built 33 years ago, before the fire



Interior of the old box showing the slide handles for working the signals
RECONSTRUCTION OF BROMLEY NORTH SIGNAL BOX, SOUTHERN RAILWAY

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QUICK REPLACEMENT OF A BURNT SIGNAL BOX ON THE SOUTHERN RAILWAY

The signal box at Grove Park, Southern Railway, was burnt out on August 23 and reconstructed and in service by September 4

As reported in our issue for August 26, the important main-line signal box at Grove Park, Southern Railway, situated in the fork of the junction of the London—Dover line, *via* Sevenoaks, and the Bromley North branch, was seriously damaged by fire on the night of Tuesday, August 23.

The Original Equipment

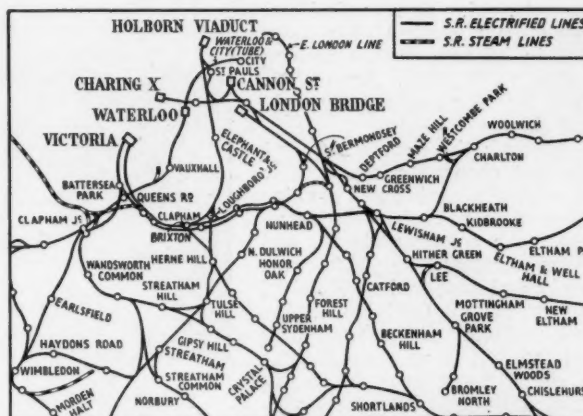
The old signal box had been in use for 33 years and was one of a small number of its type installed on the St. Johns to Orpington widening, and at Folkestone Harbour, on the former South Eastern & Chatham Railway, some of which have since disappeared. It was constructed on the Sykes electro-mechanical system, the points being worked mechanically by full-sized levers in the customary manner, and the signals electrically from slide handles, arranged above the mechanical levers and fitted with a special miniature form of Sykes lock-and-block. The running signals were semaphores, operated by 30-volt d.c. machines; shunt signals were of the banner type. Similar equipment, differing only in some constructional details, was installed from Victoria terminus to Battersea Park, on the Brighton line, and at Dalry and Glasgow (St. Enoch) on the Glasgow & South Western Railway.

When first installed the Grove Park signal box—then called Grove Park A—had 31 mechanical levers and 44 electrical slides; 10 of the former and 7 of the latter were spare. A few minor modifications have been made since, chiefly in connection with the abolition of the B box, which formerly stood at the north end of the Chislehurst tunnels. There was also at one time a signal box at Elmstead Woods station, at the north end of which the Grove Park up distant signals now stand, but it was abolished many years ago and the next block post south of Grove Park is now the Chislehurst Goods box.

The Fire: Emergency Measures

The first signs of fire were observed by the signalman at 10.30 p.m., when smoke was seen issuing from some wire casing behind the frame. He did what he could with the fire extinguisher and some water, but unavailingly, and the flames gained so strong a hold that he was forced to leave the box. The fire brigade was summoned and, after current had been cut off the live rails in the vicinity, endeavoured to quell the outbreak, but by 11.30 p.m. the box was practically burnt out, the upper part being gutted and the apparatus rendered useless. The built-on extension at the north end at ground level, housing the accumulators, charged from mains coming from Hither Green and feeding the signal circuits, was saved practically unaffected.

Emergency measures were put into force as speedily as possible. The through and local line block circuits were put through direct between Hither Green Sidings C box and Chislehurst Goods at 3.0 a.m. on August 24, hand signalling being provided until the running stop signals could be secured in the "off" position, all points, of course, being clip locked. The down distant signals were left at "caution" but fitted with "out of use" crosses. The up distant signals were at first fixed to the "on" position and also the up distant signals to Hither Green Sidings, owing to the latter being slotted with Grove Park signals. Temporary electrical connections were arranged as quickly as possible



Key map showing the situation of Grove Park at the junction of the main Charing Cross—Dover line and the Bromley North branch

to enable the Sidings C up distant to function in their normal way, and the Grove Park up distant were then fixed in the "off" position. Arrangements were made to work traffic on the Bromley North branch by a six-car shuttle train, without fixed signals or block, flagmen being stationed to move, clip, and hand-signal the few points needing working to bring it in and out of the up bay line. The London trains usually run to Bromley North were maintained at their ordinary schedules and sent on to Chislehurst where they were reversed. The practical effect of these arrangements was to put Grove Park station out of use as a signalling point. Telephone communication was provided by installing temporary instruments in the porters' room on the up local platform. The internal wiring in the signal box was destroyed, as well as incoming cables entering the box.

Repairing the Damage

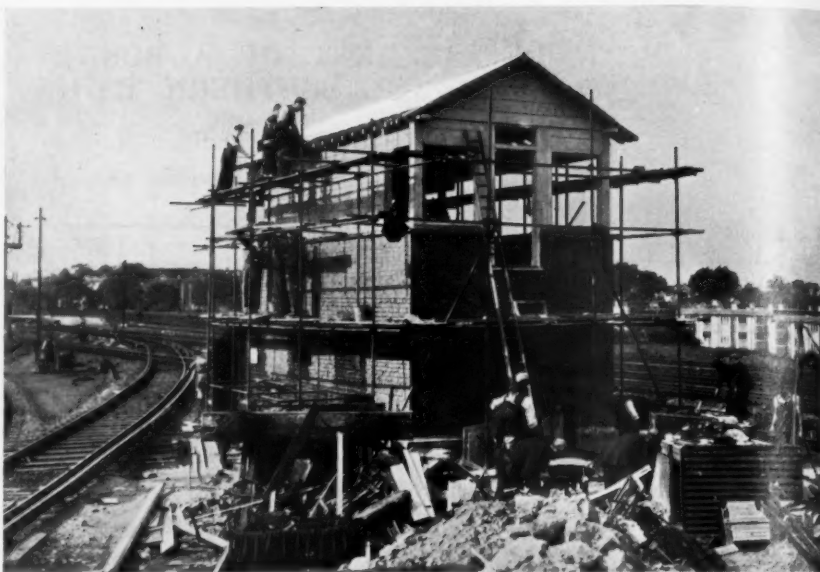
It would not have been practicable, even had it been desired, to make a new set of equipment similar to the old in a short time; moreover, the apparatus was of an out-of-date design which would not be adopted today. Very fortunately an 80-lever locking frame of Westinghouse type, now standard for new work, except all-power boxes, on the Southern Railway, was ready for installing at Twickenham. This was shortened to 60 levers and sent to Grove Park, with the necessary modifications to the locking, lever plates, and painting, and the Westinghouse electric lever locks and circuit controllers moved from above to below the frame, to allow room for the Sykes lock-and-block undergear; the contact combinations were changed to meet the altered requirements.

As the brick underportion of the old box had full-sized levers for the points and f.p. locks only, it was not long enough for this frame and had to be lengthened 6 ft. at the south end, necessitating the removal of a telegraph pole at the foot of the steps, and new cables to the box. Arrangements were at once made to reconstruct and extend this portion of the old structure, increasing it in height to reach to just below the new wooden top portion, which

was begun the day after the fire at the Angerstein shops, Westcombe Park (where the S.E. & C.R. signal shops were formerly situated). This was sent down to the site by road on Wednesday, August 31, and put in place that night by a steam crane. The new structure is 3 ft. higher than the old. New vertical and longitudinal steel girders were put in to support the locking frame on Sunday, August 28. Work went on continuously night and day.

Although the signalling layout was not changed a considerable amount of planning and drawing office work was, of course, necessary; the complete circuit, and other plans and diagrams, were ready and approved on Monday, August 29. Ordinary Sykes lock-and-block instruments were got ready, from among those rendered superfluous by recent changeovers to colour-light installations, with certain parts and accessories provided by the original makers. Three-position block indicators are in use towards Hither Green, but two-position ones in the down direction. The old electrical slides had indication check locking for the signals, but complete arm proving has now been put in, using Siemens-General Electric polar relays in the signal repeater circuits. This has necessitated certain additional wiring, with new multi-core cables and runs from the box towards the station and corresponding test cases, of the Sykes sheet steel pattern, now in extensive use on the line. Similar cases are also to be found under the box, with new steel relay racks made in the Wimbledon signal shops, and cupboards and other woodwork constructed by carpenters on the site.

The leadout for the point rodding had, of course, to be altered to suit the different positions of the new levers. The



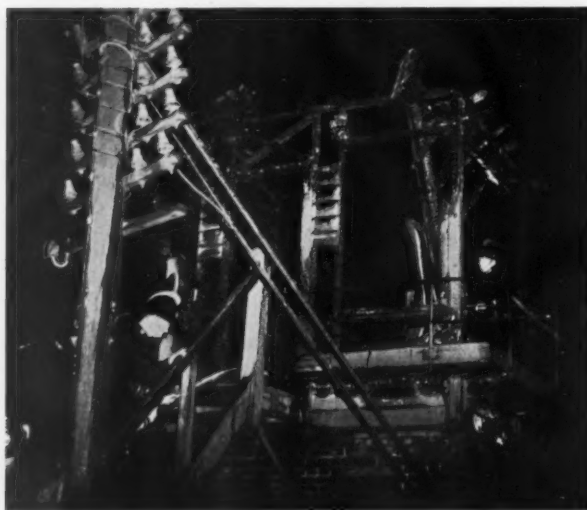
The damaged signal box at Grove Park under reconstruction. The main lines are behind the box, and Bromley North branch down line immediately to the left of it

signalman now has his back to the main lines; in the old box he faced them, and the numbering is therefore entirely different. The five a.c. track circuits previously existing have been connected to give the same controls as before. The wiring up of the new equipment was begun on Thursday, September 1, and completed and checked in the short space of three days.

The prompt measures taken, and rapid planning and execution of the restoration work, have reduced to a minimum the effect on the train services and hence the inconvenience to the public resulting from the destruction of such an important signal box, dealing with a very heavy service, especially at peak periods. Much credit is due both to staff and workmen, in all the departments concerned, for their efficient service and co-operation, which have built the new signal box in twelve days and enabled full train operation to be resumed. The whole of the work has been carried out under the direction of Mr. George Ellson, Chief Engineer of the Southern Railway.

Commercial Photography Exhibition

An exhibition of commercial work by members of the Professional Photographers' Association is being held from September 5-16, at the Royal Institute Galleries, Piccadilly, London, W. Together with examples of modern camera technique for publicity and press purposes, there are special sections entitled "Photography Serves Mankind," and "Best Press Pictures of 1938." An exhibitor in the former section is Aerofilms Limited, which, in a display showing the processes of aerial photographic surveying, illustrates how aerial views of railway layouts assist in the preparation of electrification schemes. Among the selections of *The Yorkshire Post* in the "Best Press Pictures" section is a view of the L.N.E.R. West Riding Limited hauled by *Golden Fleece*. We noted among the general work by commercial photographers a study entitled "Envy," by Charles E. Brown. Here is presented the familiar scene of a group of children on a railway bridge, held temporarily spellbound by the passing of an express. Their attitudes, although no faces are shown, are eloquent of the fascination of the train and the art of the engine driver.



Condition of Grove Park signal box immediately after the fire

RAILWAY NEWS SECTION

PERSONAL

Lord Horne, Chairman of the Great Western Railway, has accepted the presidency of the Railway Convalescent Homes for the year 1939.

Colonel the Lord Stamp, G.C.B., G.B.E., has recently accepted the appointment of Honorary Colonel of the Transportation Units, Royal Engineers (Supplementary Reserve). On Thursday, September 1, Lord Stamp dined in the Officers' Mess of the Railway Training Centre, Royal Engineers, at Longmoor Camp, for the first time in his official capacity as Honorary Colonel, and accompanied Lt.-General Sir Reginald S. May, K.C.B., K.B.E., C.M.G., D.S.O., p.s.c., the next day on the inspection by the latter of the R.E. (S.R.) units in camp. The units inspected were H.Q. Railway Stores Group, No. 151 (G.W.) Railway Construction Company and No. 156 (S.) Railway Transportation Stores Company.

Lord and Lady Stamp, together with Lord and Lady Brocket and Mrs. Mark Kerr, are among the British visitors to Nuremberg for the German National Socialist Party Congress.

The late Lt.-Colonel Sir John Humphery, Chairman of the Proprietors of Hays Wharf Limited, left estate valued at £171,031 (£74,820 net). Colonel Humphery's death in July last was recorded in our issue of August 5.

Mr. C. A. Smith, who will shortly retire from the position of Shipping Manager, South African Railways and Harbours, will continue in the capacity of Secretary to the Shipping Board, and is being retained as consultant to the administration on harbour matters.

Mr. A. F. Hayes will take over the position of Shipping Manager.

SOUTHERN RAILWAY ADVERTISING CHANGES

The directors of the Southern Railway have approved the appointment of Mr. J. Harrad, Chief Assistant (Publicity), to be Assistant Advertising Officer in succession to Mr. F. V. Milton, whose retirement on August 31 was announced in our issue of August 26.

Other changes in the Advertising Department are:—

Mr. E. W. Barnes, to be Outdoor Assistant.

Mr. G. R. Walter, to be Public Relations Assistant.

A portrait of Mr. Harrad, and biographies, appear on pages 462 and 463.

Mr. E. S. Cox, whose appointment as Technical Assistant to the Indian Pacific Locomotive Committee was recorded in our issue of July 29, received his training in the Horwich locomotive works of the former Lancashire & Yorkshire Railway, under Mr. George Hughes. In 1921 he entered the Locomotive Drawing Office at Horwich, and was transferred in 1925 to the Locomotive Drawing Office, Derby, L.M.S.R., where from 1927 onwards he was in charge of locomotive testing. Mr. Cox



Mr. E. S. Cox

Appointed Technical Assistant,
Indian Pacific Locomotive Committee

was transferred to the staff of the Chief Mechanical Engineer at Euston in 1931, and in 1934 was appointed Assistant Works Superintendent, Locomotive Works, Derby. He was appointed to his present position with the L.M.S.R. of Personal and Technical Assistant, C.M.E. Department, Euston, in November last year.

Mr. K. C. Bakhle, whose appointment as Secretary of the Indian Pacific Locomotive Committee was announced in our issue of July 29, was born in Karachi in 1898, and educated in England at Dulwich College, London University, graduating as B.Sc. Engineering with Honours. After a pupilage under Colonel H. F. Stephens, R.E., on construction of the North Devon & Cornwall Junction Railway during 1923, he joined the Great Indian Peninsula Railway as an Assistant Engineer on March 1, 1924, being concerned with the Bombay suburban electrification. In 1925 Mr. Bakhle was appointed Resident Engineer in charge

of maintenance on the Bombay sub-division, and in 1928 became Liaison Officer for the staff of the mechanical workshops at Parel and Matunga (Bombay). Mr. Bakhle was appointed Resident Engineer in charge of construction in the Bombay sub-division in 1929, and subsequently held the post of Assistant Deputy Agent, Works, in 1930-32. As Assistant Executive Engineer on regirding of bridges from 1933-34, he was in charge of the regirding of two major main-line



Mr. K. C. Bakhle

Appointed Secretary of the
Indian Pacific Locomotive Committee

bridges under traffic. In 1934 Mr. Bakhle was transferred to the Bhopal sub-division, and for nine months in 1935 worked as Personal Assistant to the Chief Transportation Superintendent. After holding various other posts in the Engineering Department. Mr. Bakhle was at the beginning of the present year appointed Divisional Engineer, Nagpur Division.

Mr. F. L. Smith, whose retirement on September 30 from the post of Accountant, L.M.S.R. (Northern Counties Committee), was announced in our issue of August 5, joined the service of the former Midland Railway as a junior clerk in the Audit Office in 1892. In 1904 he was appointed personal clerk to the Assistant Accountant, and in 1919 was transferred to Belfast to take charge of the Accountant's Department (N.C.C.) in succession to Mr. W. V. (now Sir William) Wood. He was a Member of the Accountants' Committee formed during the period of Government control of the railways, 1919-21,



[Henri]

[Belfast]

Mr. F. L. Smith

Accountant, L.M.S.R. (Northern Counties Committee) 1922-38



[Photo]

[Lafayette]

Mr. T. B. Maitland

Solicitor (Scotland), L.N.E.R., 1924-38; and Rating Agent, 1932-38

**Mr. J. Harrad**

Appointed Assistant Advertising Officer, Southern Railway

and in 1922 was appointed Accountant of the Northern Counties Committee. Mr. Smith has been associated with the division of Government compensation after de-control of the railways; the Coleraine deviation scheme; the Carrickfergus and Whitehead widening; the Greenisland loop; and the acquisition and sale of road services. He was a Member of the Accounts Advisory Committee formed in connection with the Northern Ireland Transport Po-ling Scheme.

Mr T. B. Maitland, S.C.C. (Member of the Supreme Courts in Scotland), whose retirement on September 30 from the post of Solicitor and Rating Agent (Scotland), L.N.E.R., was announced in our issue of August 5, was before the grouping Senior Solicitor in Aberdeen of the former Great North of Scotland Railway. He had a distinguished career as a student of Aberdeen University, where he was Prize-man in Scots Law and Conveyancing. For a short time he was Senior Assis-

stant to the late Mr. George Davidson, who at the time of the amalgamation of the railways was appointed Solicitor (Scotland) of the L.N.E.R. Upon Mr. Davidson's transfer to York as Divisional General Manager, Mr. Maitland was appointed Solicitor (Scotland) in 1924, and subsequently he was appointed as Rating Agent (Scotland). He has also acted as Compensation Officer for the Southern Area. Altogether he has had 42 years' experience of railway law, with which he is

Fire on Canton-Kowloon Express on January 16, 1937



The two pictures reproduced were taken with only a short interval between them. The first shows coach No. 92, in which 84 persons lost their lives, burning, the first four coaches of the train having been drawn forward from the remainder. In the second picture the front coach has been drawn away from the blazing portion, and the two coaches next to the one which initially caught fire are now burning rapidly. The suddenness with which this fire broke out and the rapidity with which it spread were the remarkable features of the accident. There were no casualties in the two coaches on each side of No. 92, and they were eventually gutted. The occurrence is referred to in our editorial on page 443

thoroughly conversant in all its branches.

Mr. J. Harrad, whose appointment as Assistant Advertising Officer, Southern Railway, is announced on p. 461 began his railway career with the former London & South Western Railway. After station and divisional office experience, he was attached to the Special Trains Section of the Office of the Superintendent of the Line, L.S.W.R., Waterloo station, and in 1901 transferred to the Traffic Advertising Section, of which he was appointed head in 1912. In 1913 Mr. Harrad was transferred to the General Manager's Office as Assistant to the Chief of the newly-formed Publicity Department, with the subsequent additional appointment of Assistant Editor of the staff magazine. In 1926 he was promoted to Indoor Assistant, and in 1930 to Chief Assistant (Publicity).

Mr. E. W. Barnes, whose appointment as Outdoor Assistant, Southern Railway Advertising Department, was recorded on p. 461, entered the L.S.W.R. Company's service in June, 1896, in the Locomotive Department, Basingstoke, and was transferred to the Locomotive Department Accountant's Office in 1898. In 1923 he was transferred to the Outdoor Section of the Advertising Department, and has been in charge of that section since June, 1935. Mr. Barnes has represented that department on the Modernisation Committee dealing with the general improvement of stations.

Mr. G. R. Walter, A.C.G.I., A.M.Inst.C.E., who, as announced on p. 461, has been appointed Public Relations Assistant, Southern Railway Advertising Department, was educated at King's College School, Wimbledon, and at the Imperial College, South Kensington. He subsequently joined the staff of Sir Harley H. Dalrymple Hay, M.Inst.C.E., Consulting Engineer, and was engaged on the construction of the tube extensions to Edgware and to Kennington. In February, 1927, he entered the service of the Southern Railway in the Engineer's New Works Department, where he had experience in the drawing office and later as Resident Engineer on various works. In September, 1932, Mr. Walter was transferred to the General Manager's Advertising Department, and was appointed Indoor Assistant in 1936.

We learn with regret of the death on August 9 at Colombes (Seine) of M. Joseph Pavie, who held after retirement the rank of Honorary Engineer to the former French State Railways. He was for many years connected with the signalling on those railways and their predecessor, the Ouest system of lines; after retiring he devoted his attention, among other things, to writing a book

on the theory and practice of interlocking. This work, in which the subject is treated with a completeness seldom, if ever, equalled appeared last year and was reviewed in our issue for August 20, 1937. M. Pavie was among those who received the members of the Institution of Railway Signal Engineers at their summer meeting in Paris in 1931.

Mr. M. L. Cobb, M.C., Senior Engineer, Nigerian Railway, has been appointed Chief Engineer, Tanganyika Government Railways.

The late Mr. A. Jackson, a Director of the Great Southern Railways, Eire, left property in England valued at £9,021.

The Governor General of India has nominated the Honourable Mr. A. G. Clow, C.S.I., C.I.E., I.C.S., to be an official member of the Central Advisory Council for Railways. Mr. Clow will be the Chairman of this council.

INDIAN RAILWAY STAFF CHANGES

Mr. C. H. C. Bowen, Chief Engineer, M. & S.M.R., has been granted leave preparatory to retirement, as from August 25.

Mr. F. J. C. Hanson, Deputy Chief Engineer, has been appointed to act as Chief Engineer in Mr. Bowen's place.

Mr. K. B. Ray has been appointed to officiate as Deputy Chief Engineer, E.B.R., as from July 15.

Rai Bahadur R. P. Varma has been appointed to officiate as Divisional Superintendent, N.W.R., as from June 16.

Mr. R. V. Ramchandani has been appointed to officiate as Deputy Chief Accounts Officer, E.I.R., as from July 29.

We regret to record the recent death, after an operation, of Mr. Rowland Janson, M.I.Mech.E., who for the past 16 years had been controlling the Railway Department of Silvertown Lubricants Limited, and in that capacity was known and greatly esteemed among a wide circle.

Dr.-Ing. F. Gläsel has been appointed Signal Superintendent of the Berlin Division of the German State Railway. Born in 1886, Dr. Gläsel studied civil engineering at Dresden and entered railway service in 1912. In 1922 he took charge of the Psychotechnical Laboratory at Dresden, which is occupied chiefly with making examinations of locomotive drivers and those qualifying to become such, and was appointed Technical Assistant to the Signal Superintendent of the Berlin Division in 1927, where he had much to do with the mechanical train-stop apparatus adopted in connection with automatic signals. In 1934 he became

Telegraph and Telephone Superintendent at Breslau and also gave courses of lectures on signalling at the Technical High School there; in 1935 Dr. Gläsel went to the firm of Carl Zeiss at Jena for special work in connection with the optical train control system.

From *The London Gazette* of September 2: Regular Army Reserve of Officers, Royal Engineers, Transportation: Lt. J. Athey, from Supplementary Reserve of Officers, Royal Engineers (Transportation), to be Lieutenant, retaining his present seniority (August 31).

Supplementary Reserve of Officers, Royal Engineers, Transportation: Capt. D. S. Gribble, from Regular Army Reserve of Officers, Rifle Brigade, to be Major (September 3).

The National Union of Railwaymen, which has this year attained its Silver Jubilee, will hold a dinner in celebration of the event on September 24. An invitation has been accepted by Mr. J. H. Thomas, formerly General Secretary of the union.

It is with regret that we record the death on September 4 of Mr. W. H. Scott, founder and Chairman of Laurence, Scott & Electromotors Limited, maker of the Scott dynamo, and of motors for cranes, lifts, and other applications requiring special designs.

Some inaccuracies occurred in the list we published last week of L.M.S.R. representatives at the funeral of Mr. Alexander Newlands, formerly Chief Engineer of the company, at Glasgow on August 30. The amended list is as follows:—

Messrs. Charles Ker (representing Lord Stamp and the directors), John Ballantyne (Chief Officer for Scotland), T. H. Moffat (Secretary of Scottish Committee, also representing Mr. O. Glynn Roberts, Secretary of the company), Capt. J. W. Harris (Marine Manager), Messrs. John W. Melville (representing Mr. W. K. Wallace, Chief Civil Engineer), A. H. McMurdo (Divisional Engineer, Scotland), R. W. Gairns (District Engineer, Glasgow Central), W. Paterson (District Engineer, Inverness), C. Marsden (District Engineer, Irvine), E. F. C. Trench (formerly Chief Civil Engineer), W. Crozier (late Operating Superintendent, Scotland), A. W. Donaldson (late Assistant Engineer), A. J. Easton (late Stores Superintendent, Caledonian Railway), A. S. Hampton (late Signal and Telegraph Engineer, Scotland), A. Bishop, J. C. Tod, and J. H. Anderson (late District Engineers), A. H. Edwards and H. H. Lord.

We regret to record the death on September 7, at the age of 78, of Sir Basil Mott, Bt., C.B., F.R.S., senior partner in the firm of Messrs. Mott, Hay & Anderson, consulting engineers. He was born in 1859, and from 1886-90 was assistant to J. H. Greathead on construction of the City & South London Railway—the first of the deep-level tubes. Later, in partnership with Sir Benjamin Baker, he was Engineer for construction of the Central London

Railway. With the firm of Mott, Hay & Anderson he was concerned in numerous schemes relating to bridges and road transport improvements (including the Mersey road tunnel); and with tube railway extensions and improvements. He was President of the Institution of Civil Engineers in 1924.

We regret to record the sudden death on Tuesday, September 6, in his 84th year, of Mr. Frederick Liddell Steel, who was from the date of grouping, until May 31, 1937, a Director of the London & North Eastern Railway Company and Chairman of its Stores Committee. Mr. Steel joined the board of the former Great Northern Railway Company in 1903, and for the last ten years before grouping was Deputy Chairman. He also represented the two companies on the Cheshire Lines.

Staff and Labour Matters

Trade Unions—Chief Registrar's Annual Report

According to the annual returns of trade unions compiled by the Chief Registrar of Friendly Societies, the registered trade unions of Great Britain have now a bigger membership than ever before in the history of the movement, and possessed funds amounting to £18,141,450 at the end of last year. At the end of 1937 there were 433 registered trade unions, with a total membership of 4,695,065. Membership in 1927 was 3,903,048, and the funds of the unions stood at £9,709,538. Members' contributions have increased from £7,354,042 in 1927 to £8,386,917 in 1937.

The transport and general labour trade has the largest membership with 1,673,170 in twenty-seven unions paying £2,278,008 a year in subscriptions. From the metal, machine, and implement trades the movement draws 790,771 members, who have 66 unions paying £2,070,431 a year. Mining and quarrying, with 87 unions, have a membership of 639,552, who pay £830,890. The other leading industrial groups are commerce 353,555 members (subscriptions £524,849); building 313,820 members (subscriptions £829,789); and textiles 190,642 members (subscriptions £322,974). The wealthiest groups are the transport and general labour with funds of £5,715,430; metals and machines £4,289,231; paper-making and printing £1,631,652; mining and quarrying £1,624,945; and textiles £1,324,794. Increased membership was shown in every group with the exception of fishing.

Short-time in G.S.R. Workshops

Notice has been given that the Great Southern Railways workshops in the Dublin area are to close on September 12 for a fortnight, and thereafter the shopmen will be employed on a three-day-a-week basis, as circumstances permit. The notice reads as under:—

"Notice to all staff employed by the

Great Southern Railways Company under shop conditions.

"In view of the serious financial position of the company, it is imperative that there must be an immediate reduction in the expenditure of all departments in order that the company's current liabilities shall be brought within its income during the remainder of the current year.

"Employees are notified that a part of the scheme to give effect to this stringent necessity involves the closing down of the company's workshops in the Dublin area for two weeks on and from 12th instant and on and from that date all other workers employed under shop conditions in the company's employment, excluding shop staff in the Chief Mechanical Engineer's Department engaged in running repairs, will be employed on a weekly three-day basis.

"On the reopening of the company's shops in the Dublin area work on a weekly three-day basis will be available subject to prevailing circumstances."

The staff is naturally very perturbed and meetings of the men concerned have been held to discuss the situation. Representatives of the Great Southern Railways, the Dublin Trades Council, and the unions affected by the notices issued by the company, met on September 6 and reviewed the situation, and decided to meet again at an early date. On September 6 the representatives of the engineering and allied groups affiliated to the Dublin Trades Council met Mr. Lemass, Minister of Industry and Commerce. Mr. Lemass was, however, unable to intervene. There is, however, a possibility that legislation may soon be introduced to secure to the railways traffic now being lost as a result of loopholes in the Road Transport Act of 1933.

Railway and Other Reports

Silverton Tramway Co. Ltd.—The report for the year to June 30, 1938, shows revenue of £174,645. After deducting £94,047 for administration, working expenses, and taxes, and £17,116 for depreciation, there remains a profit of £63,482. Adding £6,123 brought in makes a total of £69,605 available. Of this amount the interim dividend takes £25,000, sums amounting to £6,250 are transferred to special reserve for repayment of capital, £700 to reserve accounts, and £4,000 as an additional provision for income tax, leaving a balance of £33,655. The directors have appropriated £25,000 for payment of a final dividend, leaving £8,655 to be carried forward.

Port of Rangoon.—The report of the Commissioners for the Port of Rangoon for the year ended March 31, 1938, shows that income was Rs. 70,96,781, a decrease of Rs. 1,31,406 in comparison with the previous year. Dues on goods brought in Rs. 38,88,060, compared with Rs. 39,70,748, the difference being due to the rebate of 6½ per cent. on river dues introduced at the beginning of the year. Dues on vessels fell from Rs. 17,04,064 to Rs. 16,83,177, because of a smaller tonnage of vessels entering the port. Further reductions

in charges have been made as from April 1. Total expenditure was reduced from Rs. 69,75,689 to Rs. 63,57,224, mainly because of a decrease under interest and sinking fund charges. Rail-borne tonnage was 753,875 tons, against 780,072 tons in 1936-37, and river-borne tonnage 765,776 tons, against 806,500 tons.

Cammell Laird & Co. Ltd.—The directors have declared an interim dividend of 4 per cent. on the ordinary stock in respect of the year 1938. No interim distribution was made last year, but the dividend for the whole year 1937 was 8½ per cent.

Barsi Light Railway Co. Ltd.—The directors propose to transfer £6,500 to the reserve for renewals and recommend a final dividend of 2 per cent., less tax, on the ordinary stock, making with the interim of 2 per cent. already paid a total distribution of 4 per cent. for the year ended March 31, 1938, against 2½ per cent. for the previous year.

Pinchin Johnson & Co. Ltd.—The directors have declared an interim dividend on the £1,826,249 of ordinary capital at 7½ per cent., less tax, payable on September 30. This is at the same rate as a year ago. Sales for the first four months of 1938 were well maintained, but since May 1 there has been a moderate decrease, due to lessened consumption by certain home industries in which general trading has been less active. Overseas trading has, on the whole, been satisfactory.

Cowans, Sheldon & Co. Ltd.—Trading profit for the year ended June 30 last was £46,260, against £26,125 for the previous year, and the total profit £47,043. After deducting £3,457 for depreciation, writing down patents by £1,000, and providing £8,500 for income tax reserve, there is a net profit of £33,786. Adding £41,650 brought in gives a total of £75,436, out of which it is proposed to pay a dividend of 10 per cent., less tax, the same as for the previous year, and to carry forward £50,436.

Chilian Transandine Railway Co. Ltd.—Receipts in the year ended June 30, 1937, were £38,137, an increase of £4,990, and expenses were £5,815 higher, at £42,209, so that there was a loss on working of £4,072, against £3,247 for the previous year. The debit balance of £538,342 brought forward was reduced by sundry credits to £468,756, but the loss on working and debenture interest and amortisation charges for the year under review have made the debit balance to be carried forward £523,771. The report adds that for the first nine months of the financial year 1937-8 receipts were up some £10,000 compared with the year under review. Part of the broken section of the Argentine Transandine Railway has been repaired and traffic will shortly be resumed on the line between Mendoza and Cacheuta.

Ballast for Permanent Way Purposes

Notes on the practice of the N.E. Area of the L.N.E.R.

The consumption of ballast for permanent way purposes amounts to large quantities annually, and an article by Mr. F. L. Pawley in the current issue of the *London & North Eastern Railway Magazine* sets out some interesting details as to its production in the North Eastern Area of that company.

For some years the whole of the main lines from Shaftholme junction to Marshall Meadows have been founded on stone or slag ballast, and the electrified lines in the Newcastle district, as well as portions of other principal branches, have recently been similarly ballasted. There are, however, many sections of important lines which still require to be dealt with, whilst secondary and lines of less importance may have to wait for a long time before their sleepers are resting on anything better than an ash surface.

To meet the demand for stone and slag ballast the old North Eastern Railway acquired two premises—a limestone quarry at Hulands, near Barnard Castle, and a slag quarry at Lackenby, near Middlesbrough. From the former the output is now approximately 40,000 tons and from the latter about 100,000 tons each year.

The Lackenby slag plant, during the 28 years of its working by the L.N.E.R. and its constituent, has contributed nearly 1,660,000 tons of ballast, but it is now reaching the end of its resources, and supplies from there are not likely to continue for more than about seven years, after which the whole of the responsibility for meeting requirements will fall upon the Hulands quarry.

The Hulands quarry was acquired 26 years ago, the material obtained from it being mountain limestone of a hard quality giving an average analysis of: Calcium carbonate, 84.3 per cent.; magnesium carbonate, 2.52 per cent.; silica, 10.31 per cent.; alumina, 1.23 per cent.; organic matter, 1.64 per cent. The limestone lies under about 8 ft. of cover, and so far has been quarried to a depth of face of about 20 ft.; recent boreholes taken beneath the present floor level show that the limestone exists to a depth which will give ample supplies for many years. The face at present being worked extends for about 400 yds.

In the main, the rock can be loosened only by blasting; for this purpose holes are drilled by pneumatic power varying in diameter from 2 in. to 1 in., and up to 24 ft. in depth. The holes are filled with thameite, an explosive, sometimes to the extent of over 50 lb. The fuse which is used to effect the explosion burns at the rate of 2 ft. per min. A single blast may displace as much as 1,000 tons of rock. Some of the material from the blasting requires drilling again and a further explosion before it is small enough to be loaded into the tubs.

The face of the quarry is equipped

with spurs of narrow-gauge railway on which the tubs are worked for loading. The rakes of tubs are hauled by a petrol tractor to the crusher. Each tub carries rather less than two tons of stone. On arrival at the plant the contents are tipped into a crusher of the gyratory type in which lumps from perhaps a cubic foot downwards are converted into the size that a man could readily throw for some distance. When the crushed material falls through the machine, it lands upon belts and is conveyed to screens above, by means of which the appropriate size of stone is selected and allowed to fall into wagons waiting to convey it to its ultimate destination on the railway track. Stones that are too large are automatically returned to be crushed again, and material that is too small is collected to be put to a variety of uses as chippings. The crusher, air

compressor, elevators, and screens are all operated by two gas engines of 100 h.p. and 50 h.p. respectively, using produced gas.

At Hulands there is, in addition, a plant for making tar macadam in sufficient quantities to supply all the needs of the area for roadway and footpath surfaces. A quantity is also despatched to other parts of the system.

The slag heap at Lackenby comprises material in the form of solid slag tipped from ladles which was deposited about 1870 from the Old Cleveland iron ore foundries. Here blasting on a large scale is not necessary. The plant, however, is more extensive, consisting of four crushers, which are driven electrically by two 200-h.p. and one 130-h.p. motors.

Normally, 60 men are employed at Hulands and 85 at Lackenby, whilst 123 25-ton self-tipping railway wagons are used in connection with the plants. The quarries are controlled by Mr. H. Greveson, under the direction of the Engineer, North Eastern Area, York.

Indian Parliament and Bihta Judicial Report

On August 12 the Legislative Assembly discussed Mr. Clow's (Government) resolution to consider the judicial report on the Bihta derailment. After expressing sympathy with the sufferers he referred to the recommendation in the report, to which effect had been given, for the Pacific Locomotives Enquiry. Dealing with press criticisms of the composition of the enquiry committee, advocating more Indian members, he said that though some good technical advice could be obtained from officers employed under the Railway Board, as this was a matter in which the policy of the board itself would have to be reviewed, an enquiry by subordinates of that body could not possibly be described as independent, quite apart from any difficulties which such officers might have had in expressing themselves regarding the policy of the board.

As regards speed restrictions, there had been considerable decelerations on some lines, notably the East Indian, and these had been the subject of substantial complaint. On the question of compensation he said that no effort was being spared to effect a speedy settlement; 136 claims involving 196 casualties had been received and offers had been made in 87 cases involving 122 casualties, also the compensation offered in 36 cases involving 53 casualties had been accepted.

Two speakers maintained that an expert from America should have been included on the Pacific Locomotives Committee. An amendment by Sir A. H. Ghuznavi, subsequently adopted by the House without a division, recommended that full investigation should be made into individual responsibility of officers for the accident. Also that the committee's report and action that

might be taken in consequence should be placed before the Assembly for its consideration. Mr. Griffiths, representing the European group in the House, supported this amendment. Another member urged that inspecting officers should be given complete independence and be placed on a separate cadre not under the Railway Board.

In Mr. Clow's reply he pointed out that the judicial finding that "XB" class engines were failures in so far as the East Indian Railway was concerned, was not a general judgment on these engines as a type. He also dealt with the much-criticised permission given to Mr. Robertson (Chief Operating Superintendent of the E.I.R.) to leave India, on leave preparatory to retirement, prior to the judicial enquiry. While admitting that in the knowledge they now had Mr. Robertson's departure was unfortunate, he pointed out that in the circumstances at the time permission was granted, he (Mr. Clow) was doubtful if he would have withheld it himself; even the judge had stated that he did not realise the importance of Mr. Robertson's departure till somewhat late in the enquiry.

In accepting Sir A. H. Ghuznavi's amendment, Mr. Clow undertook to place the Pacific Locomotives Committee's report before the House, and that there should be reasonable opportunity for its discussion.

PADDINGTON STATION ROOF ALTERATIONS.—The present glazing of the roof of Paddington station with a series of hipped skylights is being altered. New glazing is now being fitted to the bay of the roof that covers No. 1 platform, and will admit more light and air, as well as being weatherproof.

NOTES AND NEWS

L.M.S.R. Staff College: First Course Begins.—The L.M.S.R. School of Transport at Osmaston Park, Derby, began its inaugural course on Monday last, September 5, when approximately 50 members of the staff from all parts of the system assembled for tuition in railway operation and commercial practice.

State Purchase of Cordoba Central Railway Approved in Principle.—A Reuters message from Buenos Aires, on Friday last, states that the Argentine Chamber of Deputies has approved in principle by 72 votes to 33 the State purchase of the Central Cordoba Railway; also that the measure would be discussed in detail forthwith.

Fatal Derailment in Canada due to Torrential Rain.—Abnormal rainfall during the night of August 31-September 1 caused a breach in the Montreal-Quebec C.P.R. main line, and into this an eastbound passenger train ran. The driver and fireman were killed and several passengers were slightly injured.

Proposed Tunnel between Lancashire and Cumberland.—A scheme for a road and rail tunnel under the Duddon estuary, linking Lancashire and Cumberland, near Barrow and Millom, has been approved by Millom Town Council, and the Ministry of Transport has referred it to the Cumberland county authorities. The tunnel would be 1½ miles long, with gradients at each end extending the full run to 3 miles, and it is claimed that it would save a journey of 13 miles by road and considerably shorten the distance by rail.

New Approaches to Seaham Harbour.—Two railway level crossings, which have long been an obstacle to the development of the district around Seaham Harbour, Durham, are to be eliminated by the building of a new road at an estimated cost of £123,000. The scheme has been approved by the Minister of Transport, who has made a grant from the Road Fund for three quarters of the cost. The balance will be borne equally by the Seaham Urban District Council and the Durham County Council.

Lubrication and Lubricants.—The Institution of Mechanical Engineers has recently published in two volumes, comprising some 1,200 pages, the Proceedings of the General Discussion on Lubrication and Lubricants, which took place in London on October 13-15, 1937. At these meetings 136 papers were presented from 12 different countries and represented all the aspects, mechanical and chemical, of the subject. The papers are classified in four groups: (1) Journal and Thrust Bearings; (2) Engine Lubrication (subdivided into internal combustion engines and reciprocating steam engines); (3) Industrial Applications; and (4) Properties and Testing. Critical summaries of the papers in the different groups are

included, as well as full reports of the discussions. The price of the two volumes is 25s.

International Sleeping Car Company.—Notice is given that the outstanding bonds of the International Sleeping Car Company 6 per cent. sterling bonds (1926 issue) will be redeemed at par on December 1, 1938, as from which date interest thereon will cease. The principal amount of these bonds will be paid in London by Erlangers Limited, 4, Moorgate, E.C.2.

Early Publication of S.R. Winter Timetables.—The winter timetables for the Southern Railway, which come into force on September 26, are already on sale at Waterloo and all other Southern Railway stations. It is announced on the front cover that the extension of electrification to Reading will be opened in January, 1939, and services shown on certain pages will be revised at that date, when a supplementary timetable will be issued.

Longest Excursion to Glasgow Exhibition.—What is believed to be the longest excursion to the Glasgow Exhibition is being run today (September 9), by the Great Western Railway. The train will leave Penzance at 3.5 p.m., and is due Buchanan Street station, Glasgow, 591 miles away, at 7.39 a.m. on Saturday morning. The train will consist of fourteen centre vestibule and dining car coaches and the 530 passengers from Cornish stations will make the round trip at about three miles a penny. They will have fourteen hours in Glasgow before beginning the return journey at 11.15 p.m. on Saturday night. The train is due to reach Penzance at 3.0 p.m. on Sunday afternoon.

Experimental Streamlined Diesel Train, L.M.S.R.—On Monday next, September 12, the L.M.S.R. is bringing into passenger service the experimental streamlined diesel-driven light passenger unit, which has recently been undergoing service tests. Driven by six 125-h.p. Leyland diesel-hydraulic traction units and capable of a maximum speed of about 75 m.p.h., the light unit is 185 ft. long and has seating accommodation for 164 passengers; it has less than half the weight of a steam train giving comparable accommodation and its cost and performance will be closely tested in comparison with steam working. It was fully described in our *Diesel Railway Traction Supplement* of April 15 last, page 770. The unit will in the first instance make three trips daily from Cambridge to Oxford at 10.42 a.m., 4.15 p.m., and 8.40 p.m., and two from Oxford to Cambridge at 1.42 p.m. (Saturdays 1.47 p.m.) and 6.25 p.m., with additional short trips from Bletchley to Cambridge and Oxford to Bletchley, making a total mileage of 462 each weekday. Including stops at Sandy, Bedford and Bletchley,

the 77 miles between Cambridge and Oxford will take about 1½ hours; the highest booked average speeds will be 53.3 m.p.h. from Bletchley to Bedford and 52.1 m.p.h. from Oxford to Bletchley.

Timber Utilisation Conference.—The Joint Committee on Materials and their Testing has been invited to send delegates to the Fourth International Conference on Timber Utilisation, which will be held in Brussels from September 15-17. Information relating to the conference can be obtained from the Secretary, Comité International du Bois, 50 Rue Neuve, Brussels, Belgium.

Free Lantern Slides.—The L.N.E.R. has just prepared a new lantern lecture on Germany, to accompany a set of 111 slides. The printed lecture and slides may be borrowed free of charge, with free conveyance in each direction. The L.N.E.R. now has no fewer than 250 sets of lantern slides dealing with various parts of Great Britain and the Continent, all of which are available to the public free of charge.

Controlled Rates on Canadian Airways.—It has been announced that passenger and freight rates on Canadian air lines will this month be brought under the control of a Federal authority, similar to that exercised over railway rates in the Dominion. It will be recalled that the Canadian National Railways owns all the stock of Trans-Canada Air Lines, an aerial passenger and freight undertaking formed on April 10, 1937, to operate coast-to-coast and other services specified by the Dominion Government.

G.W.R. Station Improvements.—Improvements are to be carried out to the main booking office and booking hall at Slough station, to cater for the volume of traffic which has increased by 60 per cent. since 1933. Improvements are also to be carried out to the refreshment rooms on the island platform, and synchronised electric clocks installed throughout the station. At Blowers Green, near Dudley, new station buildings are to be constructed. The existing buildings and the bridge on which they stand are to be demolished and the approach road closed. The new buildings will be situated in a more convenient position at the opposite end of the station, facing on to New Road, and will consist of booking hall, booking office, and parcels office.

Railway Servants' Orphanage.—The report for the year to April 30, 1938, of the Railway Servants' Orphanage, Derby, states that during that period 49 children (28 boys and 21 girls) were admitted, 40 children left, and suitable employment was found for those of leaving age. The average number of pupils maintained was 221, as against 215 the previous year. Two boys were successful in gaining scholarships to Derby Grammar School, and three boys to other secondary schools in the City. Reports received from the various schools the children attend have been consistently satisfactory. Total income

for the year was £19,645, an increase of £2,894 on the previous year, to which increase should be added the £2,000 promised by the L.M.S. Concert and Appeal Committee, which sum does not appear in the accounts for the year under review. Legacies account for £3,969 of this total increase of £4,894, and all legacies have to be invested. Subscriptions from railwaymen show a substantial increase for the fifth year in succession.

L.N.E.R. Best Kept Stations.—In addition to the awards in this competition made to N.E. Area stations (see our September 2 issue), the L.N.E.R. announces that special class prizes have been awarded to Appleby (Lincs), Bealings (Suffolk), Helensburgh (Dumbarton), Leadenham (Lincs), and St. Monance (Fife). Altogether, 121 stations have received first class prizes, 125 second class, 183 third class, 221 fourth class, and 28 certificates of commendation. Among the stations to receive prizes is Deadwater (Northumberland) in charge of a woman stationmaster;

whilst Gordon (Berwickshire), which has received a certificate, is also in charge of a woman stationmaster. In the North of England, so much public interest has been shown in the station gardens that seven excursions are being run to enable passengers to view the floral displays.

Extension of Aiguille Du Midi Aerial Railway.—According to a Reuters message, the oldest French aerial railway (*teléferique*), that of the Aiguille du Midi, in the Mont Blanc range, is to be extended to the Col du Midi (3,544 m. altitude), a more suitable position for a terminal station than the 3,842 m. summit of the Aiguille du Midi which was at first chosen for this project. Subsidies from the State, the Department of Haute-Savoie and the town of Chamonix will facilitate the work, which will take three years owing to the shortness of the fine weather at this altitude. The extended aerial railway will start from the present terminus at Glacier station (2,500 m.) and will have a horizontal length of 1,645 m. and an oblique length of 2,040 m.

British and Irish Traffic Returns

| GREAT BRITAIN | Totals for 35th Week | | | Totals to Date | | |
|---------------------------------------|----------------------|-----------|--------------|----------------|------------|--------------|
| | 1938 | 1937 | Inc. or Dec. | 1938 | 1937 | Inc. or Dec. |
| L.M.S.R. (6,834 mls.) | £ | £ | £ | £ | £ | £ |
| Passenger-train traffic... | 636,000 | 630,000 | + 6,000 | 18,766,000 | 18,763,000 | + 3,000 |
| Merchandise, &c. ... | 432,000 | 502,000 | - 70,000 | 15,711,000 | 17,040,000 | - 1,329,000 |
| Coal and coke ... | 240,000 | 241,000 | - 1,000 | 8,654,000 | 8,871,000 | - 217,000 |
| Goods-train traffic ... | 672,000 | 743,000 | - 71,000 | 24,365,000 | 25,911,000 | - 1,546,000 |
| Total receipts ... | 1,308,000 | 1,373,000 | - 65,000 | 43,131,000 | 44,674,000 | - 1,543,000 |
| L.N.E.R. (6,315 mls.) | £ | £ | £ | £ | £ | £ |
| Passenger-train traffic... | 411,000 | 406,000 | + 5,000 | 12,151,000 | 12,247,000 | - 96,000 |
| Merchandise, &c. ... | 317,000 | 351,000 | - 34,000 | 10,968,000 | 11,730,000 | - 762,000 |
| Coal and coke ... | 217,000 | 235,000 | - 18,000 | 8,177,000 | 8,570,000 | - 393,000 |
| Goods-train traffic ... | 534,000 | 586,000 | - 52,000 | 19,145,000 | 20,300,000 | - 1,155,000 |
| Total receipts ... | 945,000 | 992,000 | - 47,000 | 31,296,000 | 32,547,000 | - 1,251,000 |
| G.W.R. (3,737 mls.) | £ | £ | £ | £ | £ | £ |
| Passenger-train traffic... | 267,000 | 271,000 | - 4,000 | 7,894,000 | 7,982,000 | - 88,000 |
| Merchandise, &c. ... | 181,000 | 215,000 | - 34,000 | 6,425,000 | 6,909,000 | - 484,000 |
| Coal and coke ... | 104,000 | 114,000 | - 10,000 | 3,730,000 | 3,886,000 | - 156,000 |
| Goods-train traffic ... | 285,000 | 329,000 | - 44,000 | 10,155,000 | 10,795,000 | - 640,000 |
| Total receipts ... | 552,000 | 600,000 | - 48,000 | 18,049,000 | 18,777,000 | - 728,000 |
| S.R. (2,148 mls.) | £ | £ | £ | £ | £ | £ |
| Passenger-train traffic... | 404,000 | 414,000 | - 10,000 | 11,778,000 | 11,854,000 | - 76,000 |
| Merchandise, &c. ... | 63,500 | 69,500 | - 6,000 | 2,097,000 | 2,185,000 | - 88,000 |
| Coal and coke ... | 31,500 | 29,500 | + 2,000 | 1,045,000 | 1,062,000 | - 17,000 |
| Goods-train traffic ... | 95,000 | 99,000 | - 4,000 | 3,142,000 | 3,247,000 | - 105,000 |
| Total receipts ... | 499,000 | 513,000 | - 14,000 | 14,920,000 | 15,101,000 | - 181,000 |
| Liverpool Overhead ... | 1,317 | 1,318 | - 1 | 48,404 | 45,764 | + 2,640 |
| Mersey (4½ mls.) ... | 4,421 | 4,318 | + 103 | 152,446 | 146,189 | + 6,257 |
| *London Passenger Transport Board ... | 554,100 | 557,300 | - 3,200 | 5,586,500 | 5,553,000 | + 33,500 |
| IRELAND | £ | £ | £ | £ | £ | £ |
| Belfast & C.D. pass. ... | 3,307 | 3,467 | - 160 | 93,030 | 96,651 | - 3,621 |
| (80 mls.) | | | | | | |
| " " goods ... | 460 | 551 | - 91 | 15,007 | 17,067 | - 2,060 |
| " " total ... | 3,767 | 4,018 | - 251 | 108,037 | 113,718 | - 5,681 |
| Great Northern pass. ... | 16,250 | 16,200 | + 50 | 393,350 | 398,050 | - 4,700 |
| (543 mls.) | | | | | | |
| " " goods ... | 10,000 | 9,800 | + 200 | 308,900 | 330,150 | - 21,250 |
| " " total ... | 26,250 | 26,000 | + 250 | 702,250 | 728,200 | - 25,950 |
| Great Southern pass. ... | 52,467 | 54,281 | - 1,814 | 1,307,470 | 1,308,685 | - 1,215 |
| (2,076 mls.) | | | | | | |
| " " goods ... | 40,417 | 41,952 | - 1,535 | 1,358,290 | 1,412,929 | - 54,639 |
| " " total ... | 92,884 | 96,233 | - 3,349 | 2,665,760 | 2,721,614 | - 55,854 |

* 10th Week (before pooling)

British and Irish Railway Stocks and Shares

| Stocks | Highest 1937 | Lowest 1937 | Prices | |
|---|---------------------------------|---------------------------------|---------------------------------|--------------------------------|
| | | | Sept. 7, 1938 | Rise/ Fall |
| G.W.R. | | | | |
| Cons. Ord. | 673 ³ / ₈ | 553 ³ / ₄ | 34 | +1 |
| 5% Con. Prefce. | 127 | 108 | 90 ¹ / ₂ | -3 |
| 5% Red. Pref.(1950) .. | 113 | 109 | 99 ¹ / ₂ | — |
| 4% Deb. | 113 ³ / ₈ | 102 ¹ / ₂ | 105 | -1 |
| 4 ¹ / ₂ % Deb. | 118 | 106 | 108 ¹ / ₂ | — |
| 1 ¹ / ₂ % Deb. | 124 ¹ / ₂ | 112 | 113 ¹ / ₂ | — |
| 5% Deb. | 136 ¹ / ₂ | 122 ³ / ₄ | 126 ¹ / ₂ | — |
| 2 ¹ / ₂ % Deb. | 76 | 64 | 66 ¹ / ₂ | — |
| 5% Rt. Charge | 133 ¹ / ₈ | 118 | 119 ¹ / ₂ | — |
| 5% Cons. Guar. | 133 ³ / ₄ | 116 ¹ / ₂ | 106 ¹ / ₂ | -2 |
| L.M.S.R. | | | | |
| Ord. | 361 ³ / ₈ | 253 ³ / ₈ | 131 ¹ / ₄ | +1 ¹ / ₄ |
| 4% Prefce. (1923) | 82 ¹ / ₂ | 65 ³ / ₄ | 28 ¹ / ₂ | — |
| 4% Prefce. | 92 ¹ / ₂ | 77 ³ / ₄ | 52 ¹ / ₂ | — |
| 5% Red.Pre (1955) | 107 ³ / ₄ | 102 | 74 ¹ / ₂ | — |
| 4% Deb. | 108 | 99 ¹ / ₄ | 99 ¹ / ₂ | -1 |
| 5% Red.Deb.(1952) | 117 ¹ / ₂ | 111 | 112 ¹ / ₂ | — |
| 4% Guar. | 104 | 95 ³ / ₈ | 88 ¹ / ₂ | -1 |
| L.N.E.R. | | | | |
| 5% Pref. Ord. | 121 ¹ / ₂ | 63 ³ / ₄ | 41 ¹ / ₄ | +1 ¹ / ₄ |
| Def. Ord. | 614 | 35 ³ / ₈ | 25 ¹ / ₄ | +1 ¹ / ₄ |
| 4% First Prefce. | 79 ¹ / ₂ | 63 | 26 ¹ / ₂ | — |
| 4% Second Prefce. | 31 ¹ / ₂ | 21 | 10 ¹ / ₂ | — |
| 5% Red.Pref.(1955) | 101 ¹ / ₄ | 89 ³ / ₄ | 44 ¹ / ₂ | -5 |
| 4% First Guar. | 103 | 91 ³ / ₈ | 78 ¹ / ₂ | — |
| 4% Second Guar. | 97 ³ / ₈ | 85 ¹ / ₂ | 59 ¹ / ₂ | — |
| 3% Deb. | 84 ¹ / ₈ | 74 | 71 ¹ / ₂ | -1 |
| 4% Deb. | 107 ¹ / ₄ | 98 ¹ / ₂ | 95 ¹ / ₂ | -1 |
| 5% Red.Deb.(1947) | 113 ¹ / ₂ | 106 ¹ / ₂ | 108 ¹ / ₂ | — |
| 4 ¹ / ₂ % Sinking Fund Red. Deb. | 110 ³ / ₈ | 105 ¹ / ₂ | 107 | — |
| SOUTHERN | | | | |
| Pref. Ord.... | 98 ³ / ₈ | 83 ¹ / ₂ | 50 ¹ / ₂ | — |
| Def. Ord. | 277 ³ / ₈ | 163 ³ / ₄ | 113 ¹ / ₄ | -1 ¹ / ₄ |
| 5% Pref. | 126 ¹ / ₈ | 105 ¹ / ₈ | 90 ¹ / ₂ | -3 |
| 5% Red.Pref.(1964) | 118 | 110 ¹ / ₄ | 100 ¹ / ₂ | -2 |
| 5% Guar. Prefce. | 133 ³ / ₄ | 116 ³ / ₄ | 110 ¹ / ₂ | +1 |
| 5% Red.Guar.Pref.(1957) .. | 118 ¹ / ₂ | 111 ¹ / ₂ | 111 ¹ / ₂ | — |
| 4% Deb. | 112 | 101 ¹ / ₄ | 105 | — |
| 5% Deb. | 135 ³ / ₄ | 123 ¹ / ₂ | 126 ¹ / ₂ | — |
| 4% Red. Deb. | 113 | 105 | 106 ¹ / ₂ | — |
| 1962-67 | | | | |
| BELFAST & C.D. | | | | |
| Ord. | 5 | 4 | 4 | — |
| FORTH BRIDGE | | | | |
| 4% Deb. | 106 | 99 ¹ / ₂ | 100 ¹ / ₂ | — |
| 4% Guar. | 105 ³ / ₄ | 99 | 99 ¹ / ₂ | — |
| G. NORTHERN (IRELAND) | | | | |
| Ord. | 11 | 5 | 2 ³ / ₄ | +1 ¹ / ₄ |
| G. SOUTHERN (IRELAND) | | | | |
| Ord. | 50 | 21 ¹ / ₂ | 20 | — |
| Prefce. | 61 | 34 | 13 | — |
| Guar. | 94 ³ / ₄ | 69 ¹ / ₂ | 34 ¹ / ₂ | +1 ¹ / ₄ |
| Deb. | 95 | 82 ¹ / ₈ | 59 | -6 |
| L.P.T.B. | | | | |
| 4 ¹ / ₂ % "A" | 123 ³ / ₄ | 110 ¹ / ₂ | 117 ¹ / ₂ | -1 |
| 5% "A" | 135 | 121 ¹ / ₂ | 127 ¹ / ₂ | -1 |
| 4 ¹ / ₂ % "T.F.A." | 108 ³ / ₄ | 104 | 106 | — |
| 5% "B" | 125 | 114 ¹ / ₂ | 119 ¹ / ₂ | — |
| "C" | 99 ³ / ₄ | 75 | 74 ¹ / ₂ | +1 ¹ / ₂ |
| MERSEY | | | | |
| Ord. | 423 ³ / ₈ | 22 | 20 | — |
| 4% Perp. Deb. | 103 | 96 ³ / ₄ | 99 | — |
| 3% Perp. Deb. | 77 ³ / ₈ | 74 ¹ / ₂ | 73 ¹ / ₂ | — |
| 3% Perp. Prefce. | 68 ³ / ₄ | 61 ¹ / ₄ | 62 ¹ / ₂ | — |

CONTRACTS AND TENDERS

D. Wickham & Co. Ltd. has received an order from the Cie. Française des Ch. de F. de la Province de Santa Fé for nine petrol-driven flyweight trolleys.

Electric Locomotives and Equipment for Norway

The A/B Norsk Elektrisk Brown Boveri has received an order from the Norwegian State Railways for eight new electric express locomotives, of 2,800 h.p. each, hourly rating, and maximum speed of 110 km.p.h. (68.3 m.p.h.), for service on the international trains on the Østfold line (between Oslo East and Kornsjø on the Swedish border) and expresses in the Drammen division (between Oslo West and the South West). This forms one of the largest single orders ever received by the firm. The electrical portions of the locomotives are to be made at the workshops at Skøyen, except the transformers, which are being obtained abroad. The Thune works will construct the mechanical parts, except gear wheels and driving details. These are to come from the A.E.G. for seven of the locomotives. Such parts have hitherto not been procurable in Norway but a set is now to be made there for the remaining locomotive, although of a different design from the A.E.G. type. The total value of the contract is said to be 3,600,000 kroner, of which 90 per cent. will go to Norwegian firms, the Norsk Elektrisk Brown Boveri undertaking receiving 1,750,000 kroner. Considerable drawing work will be necessary before work can be begun in the shops; the locomotives are to be delivered by 1940.

Other orders have also been placed in connection with the electrification of the Østfold line, including equipment for the transformer station at Ski, which will supply the railway, to be furnished by Brown Boveri, line transformers from National Industries, masts and poles from the Concrete Pole Company, and steelwork from Alfred Andersen. Four motor coaches, similar to those recently supplied are also ordered for the Oslo-Ski section from N.E. Brown Boveri, with mechanical parts from Skabo Carriage Works.

Richardson & Cruddas Limited has received an order from the Madras & Southern Mahratta Railway for materials required for the strengthening of Kistna bridge.

The Pullman-Standard Car Export Corporation has received an order from the Entre Rios Railways for 350 chilled cast-iron wheels.

Permutit Limited has received an order from the Buenos Ayres Great Southern Railway for three Permutit water-softening plants.

Leyland Motors Limited has received orders from the Sheffield Corporation for 11 oil and torque converter single-decked passenger vehicles and from Hants & Dorset Motor Services Limited for two single-decked passenger vehicles.

Ransomes & Rapier Limited has received an order from the Buenos Ayres Great Southern Railway for a magnet crane to be driven by a 27-b.h.p. Lister oil engine and to be fitted with a Vulcan-Sinclair fluid coupling.

The Mannesmann Trading Co. Ltd. has received an order from the South Indian Railway Administration, to the inspection of Messrs. Robert White & Partners, for 8,600 solid drawn steel boiler tubes.

The Bengal-Nagpur Railway Administration has placed the following orders:—

Priestman Bros. Limited: Three steam-operated coal cranes.

Associated Locomotive Equipment Limited: Cylinders and Lentz OC valves for FPS class locomotives.

Geo. Turton, Platts & Co. Ltd.: 600 buffer plungers.

The North British Locomotive Co. Ltd. has received an order from the Egyptian State Railways Administration for locomotive cylinders. (Ref. No. E.S.R. 21.864, total price £270, delivery f.o.b. Glasgow.)

The G.W.R. announce the following works to be undertaken:—

BRIDGE RECONSTRUCTIONS, &c.

The following bridges are to be reconstructed:—

Public footbridge over the Vale of Neath line near Swansea Dock.

Bridge carrying the Worcester & Hereford line over a public road near Ledbury.

Bridge carrying a part of the Windsor branch and station platforms over a public road and the Windsor Gas Company's yard, at Windsor.

At Winchcombe, defects have developed in an arched bridge carrying the Cheltenham to Honeybourne line over a public road, and remedial work, involving the removal and rebuilding of one of the wing walls and the provision of a counterfort, is being carried out.

Arrangements have been agreed with the Glamorgan County Council under which they will widen Pantbach Road bridge, Whitechurch, to 50 ft.

At the request of the Glamorgan County Council, the Company will construct a new bridge, 40 ft. wide, over the railway at Barry Road, Dinas Powis.

At their own expense, the Birmingham Corporation will widen Stockfield Road bridge, Tyseley, from 25 ft. 6 in. to an average width between parapets of 93 ft.

At the request of the Herefordshire County Council, the company will reconstruct No. 4 span of Worcester Road bridge over the Locomotive & Bromyard branch, and widen it by means of a cantilever footway.

At the request of the Carmarthen County Council, the company will remove the superstructure of Spwddrs Road bridge at Trimsaran Road, and erect a new bridge, 30 ft. in width, half a chain away.

WORKS AT VARIOUS STATIONS AND DEPOTS

Blenheim and Woodstock.—The existing cart weighbridge at this station is not capable of weighing the motor vehicles in use there, and a new machine of 20-tons capacity is being installed.

Blowers Green.—The station buildings at Blowers Green are today on an overbridge which exists solely for the purpose. The bridge now requires to be renewed, and instead of doing this the opportunity is being taken to construct new and more convenient station accommodation in an improved position on the down side. There will be direct access to the down platform, while access to the platform on the up side will be via the adjoining road overbridge.

Stahlunion Export G.m.b.H. has received an order from the Bombay, Baroda & Central India Railway Administration, to the inspection of Messrs. Rendel, Palmer & Tritton, for 42,600 fishbolts.

The directors of the Great Western Railway have authorised the placing of the following contracts:—

John Wilson & Sons: Reconstruction and widening of Bilhay Lane bridge, Swan Village, Staffs.

George Wimpey & Co. Ltd.: Widening the line through Greenford for a length of about 1½ miles in connection with the North Acton to Ruislip electric lines scheme.

The Associated Equipment Co. Ltd.: Supply of twenty diesel railcar chassis.

R. Pratt Limited: Supply of one Fordson 8-cylinder 2-ton chassis, one Fordson 15-cwt. van, and one 8-h.p. Ford saloon car.

Rootes Limited: Supply of four Commer 2-ton lorries.

H. Smith: Demolition work, earthworks, drainage and ballasting for new sidings and lines near Pembrey and Burry Port station.

John Lysaght Limited: Supply of steel girders and other iron and steelwork of British manufacture.

The Turnerised Roofing Co. (Great Britain) Ltd.: Covering by Turnerised process the roof of the North goods shed, Morpeth Dock, Birkenhead.

For Swindon Works—

J. Bennie & Sons Limited: Supply of single-ended notching machine for "12" (Tank) Shop.

H. Pels & Co. Ltd.: Supply of combined plate frame plate-splitting shears and punch for "12" (Tank) Shop.

Holman Bros. Limited: Supply of electrically-driven air compressor for No. 3 Shop, Carriage Works.

The Wharton Crane & Hoist Co. Ltd.: Supply and erection of one 1-ton transporter crane and runways at Park Royal goods shed extension.

At the company's docks—

Penarth Pontoon, Slipway & Ship Repairing Co. Ltd.: Overhaul of the steam hopper barge *Foremost VI*.

Tank Wagons Required

Tenders are invited by the Madras & Southern Mahratta Railway Administration, receivable by October 5 for the supply of 16 oil tank wagons comprising one of 3,000-gal. capacity and 15 of 5,000-gal. capacity for the broad-gauge section. Specifications and forms of tender can be obtained from the company's offices, 123, Victoria Street, Westminster, S.W.1.

Rail Anchors

The Indian Stores Department is calling for tenders (Tender No. N.9603) for the supply and delivery of quantities of one piece rail anchors for the Eastern Bengal Railway. Tenders should reach the Indian Stores Department, Engineering Section, Simla, India, by September 27. Tenderers must submit with their tender a certificate from the Superintendent, Government Test House, Alipore, Calcutta, showing gripping strength and resistance to vibration of the anchors offered. A copy of the schedule of requirements and conditions of contract, together with drawings, may be borrowed from the Department of Overseas Trade.

A new Anglo-Roumanian Payments Agreement was signed in Bucharest on September 2. This agreement replaces the existing Payments and Technical Agreements between the United Kingdom and Roumania and is to come into force on September 12.

OFFICIAL NOTICES

THE MADRAS & SOUTHERN MAHRATTA RAILWAY COMPANY LIMITED invite

Tenders for:—
SIXTEEN OIL TANK WAGONS (1 of 3,000 gallons capacity and 15 of 5,000 gallons capacity) for the Broad Gauge Section.
Specification and Form of Tender can be obtained from the Company's Offices, 123, Victoria Street, Westminster, London, S.W.1.
Fee **ONE GUINEA**, which will not be returned.

Tenders must be submitted not later than 10 o'clock a.m. on **WEDNESDAY, 5th OCTOBER, 1938**.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
V. CRASTER,
Secretary.

CARRIAGE AND WAGON DESIGNER
DRAUGHTSMAN required by large rolling stock works in India. A single man, about 39 years of age, preferred, who has had extensive drawing office and practical works experience in a rolling stock works of repute. Five years' agreement, free passages, provident fund, and a salary of about £45 per month.—Apply by letter, with copies of testimonials, stating age, and whether married, to "Solebar," c/o Messrs. W. M. ABBOTT, LTD., 32, Eastcheap, London, E.C.3.

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to:—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

Universal Directory of Railway Officials and Railway Year Book

44th Annual Edition, 1938-39

This unique publication gives the names of all the principal railway officers throughout the world, together with essential particulars of the systems with which they are connected. Much general and statistical information about railways is also concisely presented.

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33, Tothill Street, London, S.W.1.

World Aluminium Statistics

Final figures for world production and consumption of aluminium in 1937, according to a review issued by the Aluminium Information Bureau, show that aluminium consumption has been in excess of production in each of the past two years; but, while world consumption has increased by 25½ per cent., production has increased by about 34 per cent. The review continues: "World production in 1937, according to figures issued by the Metallgesellschaft of Frankfurt-on-Main, was 490,600 metric tons, equivalent to 482,900 long tons, and world consumption was 501,700 metric tons, equivalent to 493,800 long tons. The principal producers of bauxite—the raw material for aluminium—were France, Hungary, the U.S.A., Italy, British and Dutch Guiana, Yugoslavia, and the U.S.S.R. The Dutch East Indies and Greece have become relatively important producers of bauxite only in the past two years."

The United States of America, and Germany, it is added, are by far the largest producers and consumers of aluminium, together accounting for 54 per cent. of world production in 1937. Production in each of these countries increased by rather more than 30 per cent. in 1937 as compared with 1936, the U.S.A. producing 132,800 metric tons and Greater Germany 131,600 metric tons. The quantities consumed in 1937 were 154,000 metric tons in the U.S.A. and 132,900 metric tons in Greater Germany, showing increases of 21·3 per cent. and 26·9 per cent. respectively over the 1936 figures.

The only country to show a decrease in production is Spain, where 700 metric

tons were produced in 1936, but no output is recorded for 1937.

World Aluminium Production

The following table shows comparative productions of aluminium in 1936 and 1937:—

| | 1936 | 1937 | Percentage increase |
|----------------------------|---------|---------|---------------------|
| Metric tons | | | |
| U.S.A. | 102,000 | 132,800 | 30·2 |
| Greater Germany | 100,800 | 131,600 | 30·6 |
| U.S.S.R. | 37,900 | 45,000 | 18·7 |
| Canada | 26,200 | 42,600 | 62·6 |
| France | 26,500 | 34,500 | 30·2 |
| Switzerland | 13,700 | 25,000 | 82·4 |
| Norway | 15,400 | 23,000 | 49·3 |
| Italy | 15,900 | 22,900 | 44·0 |
| United Kingdom | 16,400 | 19,400 | 18·3 |
| Other countries | 10,900 | 13,800 | 26·6 |
| Total, metric tons | 365,700 | 490,600 | 34·2 |
| Equiv. long tons | 359,900 | 482,900 | — |

Production in Canada increased by 62·6 per cent. to 42,600 metric tons. Nearly all the output of Canada was exported, chiefly to the United Kingdom, the U.S.A., and Japan. There were also substantial increases in production in France, Switzerland, Norway and Italy.

In the United Kingdom production increased by 18·3 per cent. to 19,400

tons; and in Switzerland by 44½ per cent to 13,000 metric tons.

World Aluminium Consumption

Aluminium consumption increased in every important consuming country throughout the world, the only decrease recorded being in South and Central America, which consume negligible proportions of the world's aluminium:—

| | 1936 | 1937 | Percentage increase |
|----------------------------|---------|---------|---------------------|
| Metric tons | | | |
| U.S.A. | 127,000 | 154,000 | 21·3 |
| Greater Germany | 104,700 | 132,900 | 26·9 |
| United Kingdom | 34,000 | 49,000 | 40·0 |
| U.S.S.R. | 38,000 | 47,000 | 23·7 |
| France | 27,000 | 28,000 | 3·7 |
| Italy | 17,000 | 26,000 | 52·9 |
| Switzerland | 9,000 | 13,000 | 44·5 |
| Other countries | 41,600 | 51,800 | 24·5 |
| Total, metric tons | 399,300 | 501,700 | 25·6 |
| Equiv. long tons | 393,000 | 493,800 | — |

Forthcoming Events

Sept. 15-24.—Model Engineer Exhibition, at Royal Horticultural Hall, Vincent Square, London, S.W.1.

Sept. 19-23.—International Management Congress, at Washington, U.S.A.
International Rail Assembly, at Düsseldorf, Germany.

Sept. 28 (Wed.).—Institution of Locomotive Engineers (London), at Inst. of Mechanical Engineers, Storey's Gate, S.W.1, 6 p.m. "The Exhaust Steam Injector," by Mr. L. Kastner.

Oct. 4 (Tues.).—L.N.E.R. (York) Lecture and Debating Society, at Railway Inst., Queen Street, 6.45 p.m. "Commercial Engineering," by Mr. J. Taylor Thompson.

Oct. 6 (Thurs.).—The Railway Club, at Royal Scottish Corporation Hall, Fetter Lane, E.C.4, 7.30 p.m. "The London & Birmingham Railway," by Mr. H. W. Bardsley.

Oct. 10 (Mon.).—Institute of Transport, at Inst. of Electrical Engineers, Savoy Place, W.C.2, 5.30 p.m. Presidential Address by Mr. Gilbert S. Szlumper, C.B.E.

Oct. 11 (Tues.).—Permanent Way Institution (Sheffield), at Royal Victoria Hotel, 7 p.m. "Rail Joints," by Mr. W. White.

Oct. 12 (Wed.).—Permanent Way Institution (London), at Underground Railways' Dining Club, Pelham Street, S.W.7, 7 p.m. "The Methods Employed in Renewing Track with 120 ft. Rails," by Mr. C. Herbert.

Oct. 18 (Tues.).—Federation of Railway Lecture and Debating Societies (N.E. Area), at Co-Operative Hall, Railway Street, York, 7 p.m. Paper on Electrification, by Mr. R. Brooks.

Institute of Transport (London), at Inst. of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. "The Transport of the Grain Harvests of the World," by Mr. C. Bentham.

Railway Share Market

Earlier in the week the new Stock Exchange account, which began on Monday, gave the appearance of showing an improved trend. Sentiment was influenced by more hopeful views as to European politics and also by the lower unemployment figures, but the volume of business was not sufficient to bring about any general improvement in values. Pending reassuring news concerning international politics, it seems doubtful if any important change can be expected in the prevailing tendency of the financial and other markets.

On balance, movements in Home railway securities have again been adverse to holders. The downward trend in the debenture, guaranteed, and senior preference stocks has not been checked, partly because the lower prices ruling in the gilt-edged market this week were an unsettling influence for fixed interest bearing securities. Nevertheless, it is still generally agreed that on investment merits the debentures and also the guaranteed stocks of the L.M.S., Great Western, and Southern

Railways, are undervalued. A better tendency was observable following publication of the traffic figures, but this was largely confined to the junior securities, the smaller decrease in receipts for the past week having led jobbers to mark prices slightly higher in some instances, particularly as the view is gaining ground that receipts during the remainder of the year are likely to be of a less depressing character.

Great Western ordinary has been a rather more active market around 34½, but the 5 per cent. preference remained out of favour and is now quoted at 89½, or at the same level as Southern 5 per cent. preference, the further decline in which would also appear unjustified. Southern deferred transferred around 12, and rather more attention has been given to the preferred stock (now around 50) on the assumption that, on present indications, there seem reasonable grounds for hopes of a dividend of 3 per cent. or 3½ per cent. for the year. L.M.S.R. 4 per cent. preference at 52

had a firmer appearance; as had the 4 per cent. guaranteed stock at 88½, at which the yield is not far short of 4½ per cent., or slightly below that now obtainable on Great Western 5 per cent. guaranteed and Southern 5 per cent. guaranteed preference. L.N.E.R. first preference declined sharply, but later showed a small improvement to 26. London Transport "C" stock, at 74, has not held best prices touched earlier this week, but encouraging views are current in regard to the final dividend, declaration of which will probably be made early next month.

More hopeful views as to the traffic outlook induced some attention to the ordinary stocks of Argentine railway companies. Some of the preference issues were also moderately better, but in various cases debentures were lower on balance, including those of Cordoba Central. American railway securities and Canadian Pacific failed to hold the improved tendency shown earlier in the week. French railway sterling bonds were marked down.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

| Railways | Miles open 1937-38 | Week Ending | Traffics for Week | | No. of Weeks | Aggregate Traffics to Date | | | Shares or Stock | Prices | | | | | |
|-------------------------------|-----------------------|----------------|--------------------|---------------------------------------|--------------|----------------------------|---------------|-------------------------|--------------------|-----------------|----------------|------------------|--------------------------|------|------|
| | | | Total this year | Inc. or Dec. compared with 1937 | | Totals | | Increase or Decrease | | Highest 1937 | Lowest 1937 | Sept. 7, 1938 | Yield % (See Note) | | |
| | | | | | | This Year | Last Year | | | | | | | | |
| South & Central America | | | | | | | | | | | | | | | |
| Antofagasta (Chili) & Bolivia | 834 | 4.9.38 | £ 13,021 | — | £ 6,340 | 36 | £ 541,520 | £ 587,210 | — | £ 45,690 | Ord. Stk. | 29 | 101½ | 11 | Nil |
| Argentine North Eastern | 753 | 3.9.38 | 9,305 | — | 1,781 | 10 | 106,439 | 100,690 | + | 5,749 | " | 181½ | 6 | 5 | Nil |
| Argentine Transandine | — | — | — | — | — | — | — | — | — | — | A. Deb. | 93½ | 60 | 80 | 5 |
| Bolivar | 174 | Aug., 1938 | 3,903 | — | 900 | 35 | 30,150 | 45,600 | — | 15,450 | 6 p.c. Deb. | 91½ | 5 | 8½ | Nil |
| Brazil | — | — | — | — | — | — | — | — | — | — | Bonds. | 17 | 9 | 6 | 85½ |
| Buenos Ayres & Pacific | 2,806 | 3.9.38 | 68,859 | — | 9,987 | 10 | 678,042 | 766,191 | — | 88,149 | Ord. Stk. | 178 | 51½ | 5 | Nil |
| Buenos Ayres Central | 190 | 23.8.38 | \$ 116,107 | — | \$ 34,000 | 8 | \$ 878,900 | \$ 1,160,700 | — | \$ 281,800 | Mt. Deb. | 41½ | 18 | 14 | Nil |
| Buenos Ayres Gt. Southern | 5,084 | 3.9.38 | 121,650 | + | 12,159 | 10 | 1,161,043 | 1,133,871 | + | 27,172 | Ord. Stk. | 33½ | 131½ | 11½ | Nil |
| Buenos Ayres Western | 1,930 | 3.9.38 | 31,452 | — | 10,856 | 10 | 345,036 | 439,021 | — | 93,985 | " | 31½ | 114½ | 8 | Nil |
| Central Argentine | 3,700 | 3.9.38 | 92,339 | — | 26,991 | 10 | 960,324 | 1,314,759 | — | 354,435 | " | 34½ | 105½ | 8½ | Nil |
| Do. | — | — | — | — | — | — | — | — | — | — | Dfd. | 20½ | 42½ | 41½ | Nil |
| Cent. Uruguay of M. Video | 972 | 27.8.38 | 16,007 | + | 1,179 | 9 | 138,327 | 128,616 | + | 9,711 | Ord. Stk. | 67½ | 2 | 2 | Nil |
| Cordoba Central | 1,218 | — | — | — | — | — | — | — | — | — | Ord. Inc. | 61½ | 11½ | 3 | Nil |
| Costa Rica | 188 | June, 1938 | 31,369 | + | 318 | 52 | 314,399 | 249,333 | + | 65,066 | Stk. | 38 | 27 | 25½ | 71½ |
| Dorada | 70 | July, 1938 | 18,900 | + | 3,800 | 31 | 114,600 | 105,500 | + | 9,100 | 1 Mt. Db. | 107 | 106 | 105 | 51½ |
| Entre Rios | 810 | 3.9.38 | 13,858 | — | 707 | 10 | 146,878 | 137,343 | + | 9,535 | Ord. Stk. | 197½ | 6 | 5½ | Nil |
| Great Western of Brazil | 1,092 | 3.9.38 | 5,400 | — | 1,300 | 36 | 227,200 | 257,100 | — | 29,900 | Ord. Sh. | 34 | 18 | 14 | Nil |
| International of Cl. Amer. | 794 | July, 1938 | \$ 444,329 | + | \$ 26,759 | 31 | \$ 3,454,817 | \$ 3,543,958 | — | \$ 89,141 | — | — | — | — | — |
| Interoceanic of Mexico | — | — | — | — | — | — | — | — | — | — | 1st Pref. | 2½ | 1½ | 1½ | Nil |
| La Guaira & Caracas | 22½ | Aug., 1938 | 5,090 | + | 10 | 35 | 40,670 | 43,200 | — | 2,530 | Stk. | 81½ | 6 | 8½ | Nil |
| Leopoldina | 1,918 | 3.9.38 | 26,947 | — | 580 | 26 | 696,020 | 819,541 | — | 123,521 | Ord. Stk. | 91½ | 3 | 2 | Nil |
| Mexican | 483 | 31.8.38 | \$ 392,200 | — | \$ 95,600 | 9 | \$ 2,347,200 | \$ 2,669,390 | — | \$ 322,100 | " | 11½ | 14 | 12 | Nil |
| Midland of Uruguay | 319 | July, 1938 | 8,682 | + | 1,041 | 4 | 8,682 | 7,641 | + | 1,041 | " | 17½ | 1½ | 1½ | Nil |
| Nitrate | 386 | 31.8.38 | 4,805 | — | 188 | 35 | 101,162 | 105,981 | — | 4,819 | Ord. Sh. | 31½ | 2 | 2 | 5 |
| Paraguay Central | 274 | 27.8.38 | \$ 166,000 | + | \$ 111,000 | 9 | \$ 27,536,000 | \$ 30,047,000 | — | \$ 2,511,000 | Pr. Li. Stk. | 84 | 791½ | 571½ | 31½ |
| Peruvian Corporation | 1,059 | Aug., 1938 | 73,687 | — | 18,900 | 9 | 147,742 | 173,721 | — | 25,979 | Prf. | 14½ | 42½ | 2½ | Nil |
| Salvador | 100 | 27.8.38 | £ 10,356 | — | £ 1,064 | 9 | £ 104,349 | £ 105,049 | — | £ 700 | Pr. Li. Db | 23½ | 21½ | 22½ | Nil |
| San Paulo | 153½ | 28.8.38 | 37,262 | + | 5,277 | 35 | 1,093,146 | 1,134,627 | — | 41,481 | Ord. Stk. | 98½ | 56 | 34½ | 119½ |
| Taital | 160 | July, 1938 | 3,510 | + | 570 | 4 | 3,510 | 2,940 | + | 570 | Ord. Sh. | 17½ | 11½ | 11½ | 135½ |
| United of Havana | 1,353 | 27.8.38 | 16,727 | — | 911 | 9 | 136,054 | 160,756 | — | 24,702 | Ord. Stk. | 56 | 31½ | 1 | Nil |
| Uruguay Northern | 73 | July, 1938 | 874 | + | 86 | 4 | 874 | 788 | + | 86 | Deb. Stk. | 10 | 2 | 2 | Nil |
| Canada | | | | | | | | | | | | | | | |
| Canadian National | 23,754 | 31.8.38 | 1,140,502 | — | 4,376 | 35 | 22,497,581 | 25,628,972 | — | 3,131,411 | — | — | — | — | — |
| Canadian Northern | — | — | — | — | — | — | — | — | — | — | Perp. Dbs. | 77 | 62½ | 63½ | 65½ |
| Grand Trunk | — | — | — | — | — | — | — | — | — | — | 4 p.c. Gar. | 101½ | 94½ | 101½ | 31½ |
| Canadian Pacific | 17,186 | 31.8.38 | 910,800 | + | 72,400 | 35 | 16,912,400 | 18,149,400 | — | 1,237,000 | Ord. Stk. | 18 | 71½ | 61½ | Nil |
| India | | | | | | | | | | | | | | | |
| Assam Bengal | 1,329 | 20.8.38 | 37,672 | + | 83 | 20 | 529,885 | 504,012 | + | 25,873 | Ord. Stk. | 86 | 73½ | 79 | 31½ |
| Barsi Light | 202 | 20.8.38 | 2,430 | — | 173 | 20 | 60,240 | 54,412 | + | 5,828 | Ord. Sh. | 66½ | 46 | 60 | 85½ |
| Bengal & North Western | 2,116 | 20.8.38 | 48,581 | — | 12,988 | 20 | 1,117,096 | 1,194,299 | — | 77,203 | Ord. Stk. | 317 | 301 | 286½ | 69½ |
| Bengal Doars & Extension | 161 | 20.8.38 | 3,900 | — | 477 | 20 | 51,809 | 52,127 | — | 318 | " | 100 | 84 | 85½ | 7 |
| Bengal-Nagpur | 3,268 | 20.8.38 | 160,200 | + | 30 | 20 | 2,675,538 | 2,723,468 | — | 47,930 | " | 101 | 89 | 92 | 45½ |
| Bombay, Baroda & Cl. India | 3,085 | 31.8.38 | 234,525 | — | 15,225 | 22 | 3,594,600 | 3,695,775 | — | 101,175 | " | 113 | 110½ | 110½ | 57½ |
| Madras & Southern Mahratta | 2,967 | 10.8.38 | 132,300 | + | 10,928 | 19 | 2,092,498 | 1,987,558 | + | 104,940 | " | 110 | 105 | 106 | 81½ |
| Rohilkund & Kumaon | 546 | 20.8.38 | 10,648 | — | 1,148 | 20 | 224,891 | 228,945 | — | 4,054 | " | 314 | 302 | 296½ | 61½ |
| South Indian | 2,531½ | 10.8.38 | 108,172 | + | 994 | 19 | 1,521,135 | 1,507,051 | + | 14,083 | " | 103½ | 99½ | 101½ | 41½ |
| Various | | | | | | | | | | | | | | | |
| Beira-Umtali | 204 | June, 938 | 89,780 | — | 1,725 | 40 | 783,061 | 676,896 | + | 106,165 | — | — | — | — | — |
| Egyptian Delta | 620 | 20.8.38 | 5,750 | — | 720 | 20 | 78,225 | 83,168 | — | 4,943 | Prf. Sh. | 31½ | 34 | 34 | Nil |
| Kenya & Uganda | 1,625 | July, 1938 | 179,913 | — | 19,221 | 31 | 1,678,207 | 1,723,478 | — | 45,271 | B. Deb | 48½ | 43½ | 42½ | 84 |
| Manila | — | — | — | — | — | — | — | — | — | — | Inc. Deb. | 98 | 93½ | 91½ | 43½ |
| Midland of W. Australia | 277 | July, 1938 | 13,243 | + | 2,998 | 5 | 13,243 | 10,245 | + | 2,998 | — | — | — | — | — |
| Nigerian | 1,900 | 23.7.38 | 28,392 | — | 7,227 | 17 | 505,297 | 852,744 | — | 347,447 | — | — | — | — | — |
| Rhodesia | 2,442 | June, 1938 | 425,403 | + | 5,522 | 40 | 3,743,259 | 3,352,058 | + | 391,201 | — | — | — | — | — |
| South Africa | 13,263 | 13.8.38 | 624,225 | — | 40,352 | 20 | 11,558,821 | 12,123,430 | — | 269,609 | — | — | — | — | — |
| Victoria | 4,774 | May, 1938 | 849,379 | + | 26,441 | 48 | 9,015,865 | 9,342,068 | — | 325,203 | — | — | — | — | — |

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1½

† Receipts are calculated @ 1s. 6d. to the rupee § ex dividend

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements are based on the current rates of exchange and not on the par value

Electric Railway Traction

Ten Years of the Berlin Stadtbahn

WITH the exception of the line out to Lichterfelde Ost, which has been worked electrically since July 1, 1903, and the three northern lines terminating at Velten, Oranienburg, and Bernau, over which electric traction began in 1924-27, the whole of the electrified network of the Berlin Stadtbahn has been converted within the last decade. In 1926 a comprehensive plan for further electrification was prepared, and comprised the conversion to the 800-volt d.c. system of 97 route miles, including the lines from the centre of the city out to Potsdam, Stahnsdorf, Grünau, Spindlersfeld, and Erkner. Through electric trains between Erkner, Berlin and Potsdam, 37 miles, began to run in the summer of 1928. Following the completion of the 1926 programme, the Wannseebahn, from the Potsdamer Bahnhof, was opened to electric traction on May 15, 1933, and the northern portion of the new Nord-Süd line on July 28, 1936. Compared with 1927, the number of passengers carried in 1937 had increased by 35 per cent., the passenger-km. by 64 per cent., and the passenger receipts by 38 per cent., while the operating expenses had decreased by 5 per cent. During the same period the Stadtbahn's percentage of the total passengers carried in Greater Berlin rose from 24.3 per cent. of 1,475 million in 1927 to 34.8 per cent. of 1,410 million in 1937. At the present time 151 route miles of the total Stadtbahn mileage of 353 is electrified. On the section with densest traffic—between Westkreuz and Ostkreuz—the installation of automatic block signalling has enabled 40 eight-car trains an hour to be operated. Each of these trains can carry 1,200 passengers. The maximum capacity which could be obtained in steam days was 26 trains an hour, and each train carried 1,000 passengers.

Metadyne Medley

THERE has long been a need in d.c. traction work for the equivalent of the a.c. auto-transformer, particularly for the starting of d.c. motors, where the voltage must be limited for a period and where such limitation by series resistances is wasteful both electrically and mechanically. The ideal arrangement would be one permitting the load voltage and the load current to be varied at will, and which would consume on the supply side no more energy than it delivered on the output side. Apart from the small iron and copper losses the static transformer fulfils this ideal for a.c. work, and for d.c. applications the metadyne forms a fairly close approximation to ideal requirements. In its simplest form the metadyne has no control over the output current, which is maintained constant irrespective of load requirements. It is by no means the first practical proposition for a constant-current traction machine, but it is the first to be applied in normal service, and the principle appears to have a wide potential application to d.c. motor control in traction and industrial fields. Although constant current may be desirable during the acceleration period, which in urban trains is an appreciable proportion of the run-

ning time, the current subsequently must be related to the tractive effort required from the motors. To that end a variator winding is incorporated in traction applications, and to maintain equality between the input and output powers, and thus enable a smaller motor and simpler controls to be used, yet a further field winding—the regulator winding—is provided. The notchless control given by the metadyne is of particular advantage in railway work—it has enabled the service acceleration of the L.P.T.B. trains to be increased by nearly 50 per cent., and in many instances its automatic regenerative features are of equal importance. What the future of the metadyne will be it is unsafe to predict, for in overcoming the defects of added weight and bulk it may grow out of itself. Nevertheless, its development into a practical traction equipment, largely the result of Metrovick endeavours, forms one of the most important steps there has been in urban d.c. traction, and for that reason we have devoted most of the present issue to a discussion of such equipment and its characteristics. Actually, the first traction application of the metadyne was on the ex-P.O.-Midi Railway, and an account of the work done will be found in the issue of this Supplement for April 30, 1937.

Traction Current Consumption in England

EXTRAORDINARILY interesting figures as to the consumption of electric energy for traction purposes in England were given by Mr. F. Lydall in his paper "The Requirements and Supply of Energy for Electric Railways" read before the Sectional Meeting of the World Power Conference in Vienna recently. It should materially assist in debunking the fairly widespread idea that railway traction current forms an appreciable proportion of the total consumption in the country. For the year 1937 it formed only 4 per cent. of the total, and of the railway total of 1,352,793,000 kW.hr., the London Passenger Transport Board took 44 per cent., of which 88 per cent. was generated in the board's own plants at Lots Road and Neasden, and only 12 per cent. was purchased. The Southern Railway accounted for another 40 per cent. of the English traction consumption, of which just over a quarter was generated in the company's station at Durnsford Road, Wimbledon. Of the total traction consumption, only about 568,000,000 kWh. are purchased, and this is equal only to 1½ per cent. of the energy generated outside of railway-owned power plants. The maximum half-hourly demand varies greatly in comparison with the average load, but in sheer magnitude the maximum is found at Lots Road power station, the demand on which in the winter rises to 93,000 kW., and is over 85,000 kW. for 2½ hr. in the morning and for 2 hr. in the evening. The load factor over a 24-hr. period in the winter at Lots Road is about 53 per cent. Over the rush-hour period with loads of 85,000 kW. the maximum momentary variation at Lots Road scarcely exceeds plus or minus 5,000 kW., but on the Western Section suburban area of the Southern Railway the momentary load is about 20 per cent. above the maximum half-hourly demand of 40,000 kW.

METADYNE CONTROL

An experimental investigation of its load characteristics

By O. I. BUTLER, B.Sc.

THE metadyne, as used on the ex-P.O.-Midi Railway and the District and Metropolitan sections of the London Passenger Transport Board's lines, may be described as a direct-current rotary transformer which converts a constant voltage supply to one of constant current. It consists essentially of an ordinary d.c. armature fitted with a set of brushes for bringing in the primary current from the overhead or third rail, and another set for leading away the secondary current generated by armature reaction.

The secondary current is fed to the traction motors and maintains a constant value provided the metadyne armature is rotated at a constant speed. This latter condition is maintained by the action of a regulating machine, usually referred to as the "regulator," direct-coupled to the metadyne.

Theoretical Analysis of the Metadyne.—For simplicity, consider a two-pole armature (lap or wave-wound) being rotated in a clockwise direction at a constant speed by an external mechanical force. If a constant-voltage supply is connected across the pair of brushes *a* and *b*

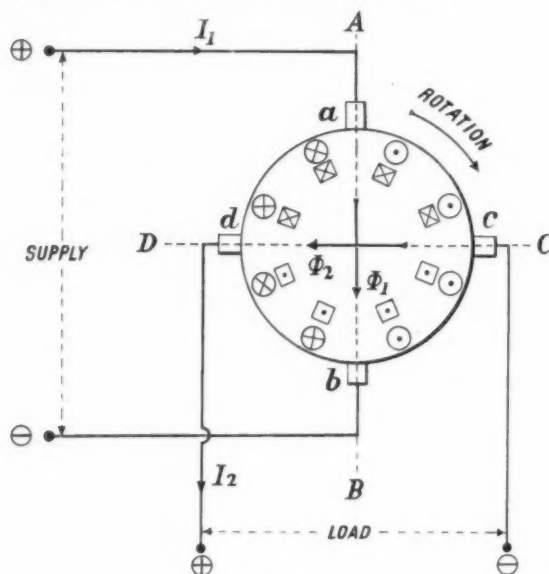


Fig. 1

(see Fig. 1) current will flow through the conductors, which are shown as a number of small circles spaced near the periphery of the armature. The current flow as shown will provide a magnetic flux Φ_1 in the line AB, which produces zero resultant e.m.f. in the rotating conductors between the primary brushes *a* and *b*; but a definite resultant e.m.f. will be produced between the secondary brushes *c* and *d*. If the latter brushes are connected externally, the armature conductors will have the further component of current flow indicated by the dots and crosses of the inner ring of squares. This latter current flow will provide a magnetic flux Φ_2 in the line CD, which in turn produces zero resultant e.m.f. between the secondary brushes, but a definite resultant e.m.f. will be produced between the primary brushes.

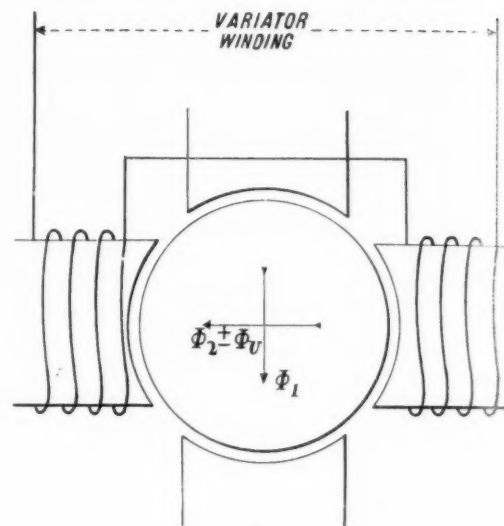


Fig. 2

It will be seen that the clockwise rotation of the armature results in the direction of this latter e.m.f. being opposed to the constant applied voltage. If we neglect the ohmic drop between the primary brushes it follows that this back e.m.f. maintains a constant value equal to the applied voltage. Hence, with the machine rotating at a constant speed, the cross-flux Φ_2 and consequently the secondary current, must maintain a constant value.

Further, if part of the cross-flux is provided by a given external m.m.f. (see Fig. 2), the secondary current must maintain a constant value less than that occurring with no external m.m.f. present. On the other hand, if a given external m.m.f. opposes the cross-flux the secondary current must maintain a constant value greater than that

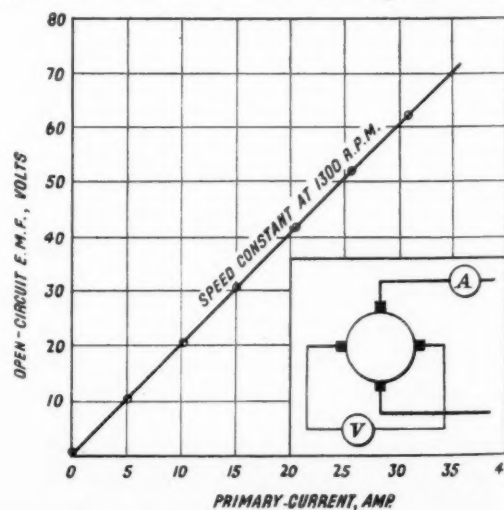


Fig. 3

occurring with no external m.m.f. present. The secondary current can therefore be varied by means of an external m.m.f. and so varying rates of acceleration obtained from the driving motors. For this reason the stator winding which produces the external m.m.f. is usually referred to as the "variator winding." It will be appreciated that a stationary magnetic shell will be required to encircle the armature to provide a low reluctance path to the component fluxes.

On the basis of the preceding qualitative study of the metadyne the following quantitative relationships between the various electrical quantities can be obtained:—

Let

- V_1 = supply voltage at primary terminals,
- I_1 = primary current,
- E_1 = back e.m.f. between primary brushes,
- V_2 = secondary terminal voltage,
- I_2 = secondary current,
- E_2 = e.m.f. between secondary brushes,
- Φ_1 = armature flux due to I_1 ,
- Φ_2 = armature flux due to current I_2 ,
- Φ_v = flux due to variator winding,
- R_a = resistance of armature,
- R_2 = resistance of external secondary circuit,
- E_b = back e.m.f. of traction motor (s).

Then

$$E_1 = K \times (\Phi_2 + \Phi_v) \quad \dots \quad (1)$$

and

$$E_2 = K \Phi_1 \quad \dots \quad (2)$$

The constant

$$K = nZp/10^8 \times 60a,$$

where

- n = speed in r.p.m. (assumed constant),
- Z = number of armature conductors,
- p = number of poles,
- a = number of parallel paths in armature.

If saturation of the magnetic circuit is neglected, the following further relationships will apply,

$$\Phi_1 = K_1 I_1 \quad \dots \quad (3)$$

$$\Phi_2 = K_2 I_2 \quad \dots \quad (4)$$

The constants K_2 and K_1 will be equal provided the corresponding magnetic circuits are identical.

We also have, in the primary circuit,

$$V_1 = E_1 + I_1 R_a = K \times (\Phi_2 + \Phi_v) + I_1 R_a \quad \dots \quad (5)$$

Further, in the secondary circuit, we have

$$V_2 = E_2 + R_2 I_2 \quad \dots \quad (6)$$

and

$$I_2 = \frac{E_2 - E_b}{R_a + R_2} \quad \dots \quad (7)$$

Combining equations (2) and (7) gives

$$I_2 = \frac{K \Phi_1 - E_b}{R_a + R_2} \quad \dots \quad (8)$$

Combining equations (3), (4) and (5) gives

$$V_1 = KK_2 I_2 + K \Phi_v + \frac{R_a \Phi_1}{K_1} \quad \dots \quad (9)$$

From equation (8) we have

$$\Phi_1 = \frac{(R_a + R_2) I_2 + E_b}{K} \quad \dots \quad (10)$$

Substituting this value of Φ_1 in equation (9) gives

$$V_1 = I_2 \left[KK_2 + \frac{R_a (R_a + R_2)}{KK_1} \right] + K \Phi_v + \frac{R_a E_b}{KK_1}$$

Whence

$$I_2 = \frac{KK_1 \times (V_1 - K \Phi_v) - R_a E_b}{K^2 K_1 K_2 + R_a (R_a + R_2)} \quad \dots \quad (11)$$

Combining equations (3), (10) and (11) we obtain

$$I_1 = \frac{(R_a + R_2) \times (V_1 - K \Phi_v) + KK_2 E_b}{K^2 K_1 K_2 + R_a (R_a + R_2)} \quad \dots \quad (12)$$

Predetermination of Load Characteristics.—The "primary current/load current" and the "primary current/load

voltage" curves of the metadyne may be predetermined mathematically for a given variation of load in the secondary external circuit if the constants K , K_1 , and K_2 are known.

The method of predetermination is as follows:

(1) The value of K is determined from the design data of the metadyne.

(2) The curve connecting primary current and secondary voltage on open-circuit is plotted, and from the unsaturated portion of the graph the ratio $\frac{V_2}{I_1}$ is determined. Under these conditions,

$$V_2 = K \Phi_1 = KK_1 I_1.$$

Whence

$$K_1 = \frac{V_2}{KI_1}$$

(3) The curve connecting secondary current and primary voltage on open-circuit is plotted, and from the unsaturated portion of the graph the ratio $\frac{V_1}{I_2}$ is determined. Under these conditions,

$$V_1 = K \Phi_2 = KK_2 I_2.$$

Whence

$$K_2 = \frac{V_1}{KI_2}$$

(4) For the case of a traction motor load (with a given constant supply voltage and rotational speed of the

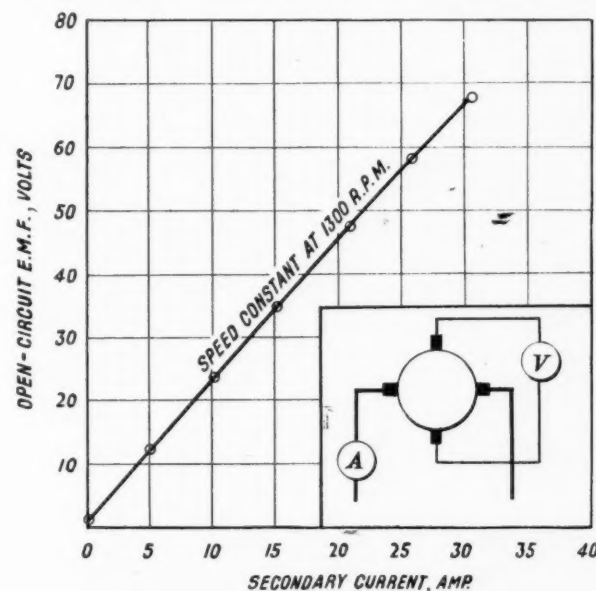


Fig. 4

metadyne) the load current, the load voltage, and the primary current are evaluated from equations (11), (6), and (12) respectively. For example:

(1) From the design data of the experimental metadyne $p = a = 2$, $Z = 372$, and $n = 1,300$ r.p.m.

Whence

$$K = 8.06 \times 10^{-5}.$$

(2) From the open-circuit curve of Fig. 3 the value of K_1 has been determined as $K_1 = 24,800$.

(3) From the open-circuit curve of Fig. 4 the value of K_2 has been determined as $K_2 = 28,600$.

(4) Assuming a sequence of values for the total back e.m.f. of the traction motors we obtain a corresponding sequence of points on the characteristics of the metadyne.

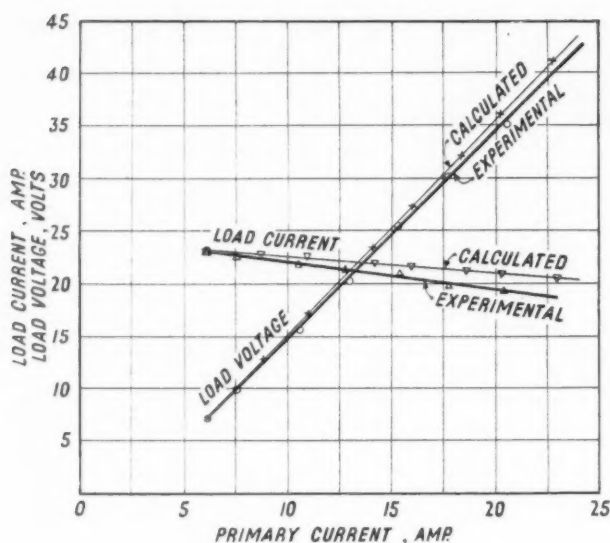


Fig. 5

The characteristics have been determined for a supply voltage of 56.25 volts and a rotational speed of 1,300 r.p.m. and are shown in Fig. 5.

Test Results.—Measurements were made upon an ordinary two-pole, 115-volt, 38.5-amp., 1,300-r.p.m. lap-wound d.c. machine modified to constitute a metadyne by (i) adding two mild-steel poles intermediate with the existing main poles, (ii) adding intermediate positive and negative brush sets, and (iii) removing the shunt winding from the main poles. The resistance of the armature was found to be 0.22 ohm, and the radial air gaps were 0.060 in. and 0.050 in. respectively for the two pairs of diametrically opposite poles.

A test was carried out with the supply voltage and the speed of the metadyne maintained constant at 56.25 volts and 1,300 r.p.m. respectively, whilst the traction motor connected in the external secondary circuit was accelerated to its full speed. A heavy flywheel was fitted to the traction motor shaft to provide an appreciable load on the motor. The results obtained are shown in Fig. 5.

Effect of Variator M.M.F.—Equation (11) shows that the presence of an auxiliary flux Φ_v assisting the cross-flux

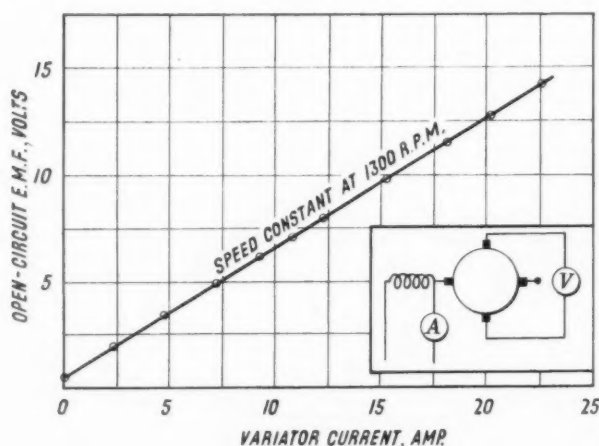


Fig. 6

Φ_2 will result in a lower constant value of the load current, provided the primary voltage and the rotational speed of the metadyne are maintained at constant values. The stator was therefore wound with a total of 50 turns to take the more or less constant load current. It is considered an advantage to use the load current for the series excitation of the variator winding, as any tendency for the load current to fall or rise is counteracted by the fall or rise of the variator m.m.f. Consequently, a more constant load current can be expected under these conditions.

Predetermination of Load Characteristics with Variator M.M.F.—The method of predetermination of the load characteristics with a variator m.m.f. present is identical with that previously employed for the case of the variator m.m.f. absent, except that it is further necessary to establish

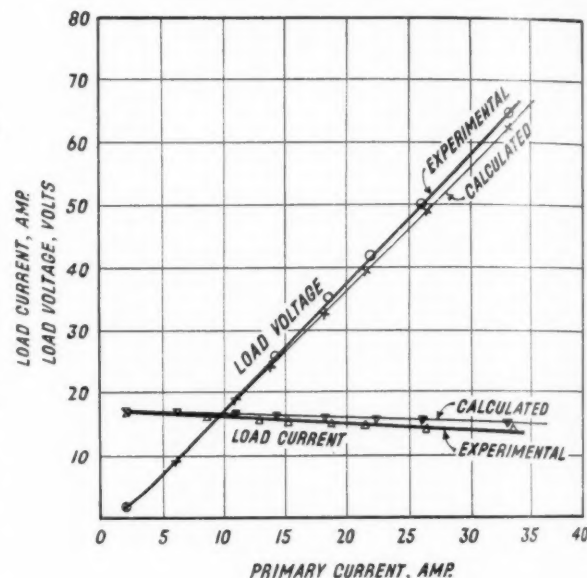


Fig. 7

a relation between the variator current I_2 and the component back e.m.f. $K\Phi_v$ which it produces in the primary circuit.

A test carried out at 1,300 r.p.m. with both primary and secondary circuits on open-circuit gave the results shown in graphical form in Fig. 6, from which is obtained the relation

$$K\Phi_v = 0.61 I_2.$$

Substituting this value of $K\Phi_v$ in equations (11) and (12) allows the calculated load characteristics of Fig. 7 to be obtained, assuming a supply voltage of 55 volts.

Test Results with Variator M.M.F.—A test was carried out with a constant supply voltage of 55 volts and a rotational speed of 1,300 r.p.m. The results of the test are given in graphical form in Fig. 7. It will be observed that close agreement exists between the calculated and experimental curves, and also that the percentage variation of the load current between given limits of the primary current is less than that which occurred with the variator winding unexcited.

Regeneration

In the denominator of the expression for the primary current, as given by equation (12), the term $(R_a + R_b)(V_1 - K\Phi_v)$ may be almost negligible compared with the value of the term KK_2E_b when the traction motors are running at speed. Consequently, if the direction of the traction motor induced e.m.f. E_b is reversed, the direction

of the primary current is reversed. That is, the metadyne is caused to regenerate. With regard to the secondary current, the term $R_a E_b$ in equation (11) is only small compared with the term $KK_1 (V_1 - K \Phi_a)$, and so reversal of the traction motor back e.m.f. results in a slight increase of the secondary current without any change in its direction of flow.

Thus, in order to regenerate, we merely require to reverse either the field or armature connections of the traction motor, but not both. Appendix I shows that it is dangerous to break the secondary circuit whilst the supply voltage is connected over the metadyne; but this complication may be avoided by separately exciting the traction motor field through a reversing switch. The reversing switch then becomes the control switch for "motoring" and "regenerating." In the case of the metadyne control system on the ex-P.O.-Midi Railway the traction motor field coils are separately excited by means of a small motor-generator set driven from the overhead line.

Also, from equation (12), it can be seen that if the term $(R_a + R_b)$ is kept at a low value, regeneration can be obtained down to almost zero back e.m.f. of the traction motor, that is, down to practically standstill. In any case, the electric braking torque can be maintained down to standstill, and even cause a reversal of motion unless removed. In practice it is usual to allow the mechanical brakes to take over control at speeds approaching zero.

Predetermination of Regeneration Characteristics and Test Results.—The method of predetermination of the regeneration characteristics is identical with that previously employed for the predetermination of the load characteristics, care being taken to comply with the algebraic significance of the induced e.m.f. E_b in the load circuit. The calculated characteristics for a constant supply voltage of 49.4 volts and a constant rotational speed of 1,300 r.p.m. are given in Fig. 8. This illustration also shows experimental curves obtained from a test carried out with the constant supply voltage and rotational speed cited above.

Oscillograph Records

Oscillograph records of the primary and secondary currents were taken during the period of change-over from motoring to regenerating, and are shown in Figs. 9 and 10 respectively. A 50-cycle alternating-current supply was used as a time-base, whilst the camera was rotated by hand at as uniform a speed as possible.

Fig. 9 shows that the time taken for the primary current to fall to zero, from a motoring value of approximately

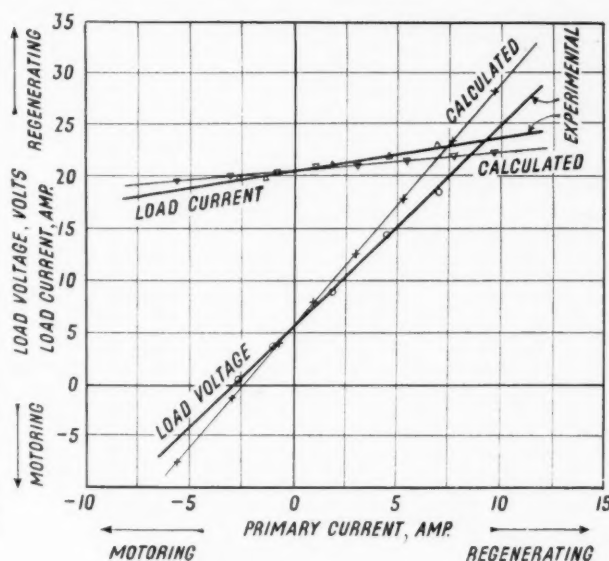


Fig. 8

20 amp. at the instant of change-over, is about $1\frac{1}{2}$ sec. The interval of regeneration then occupies approximately 5 sec., followed by an interval of motoring of about 1 sec., at the end of which the traction motor has been brought to a complete standstill and the primary supply then cut off. Fig. 10 shows the secondary current during a regeneration interval of approximately 3 sec., followed by an interval of about 1 sec. in which electric braking of the traction motor occurs down to standstill. It will be seen that during regeneration the secondary current maintains a slightly higher level than that which obtains during motoring, as previously deduced from equation (12).

An irregular commutation ripple, superimposed on a regular slot ripple, is evident in both currents. It will be appreciated that the experimental machine had not been specially designed to function as a metadyne, and poor commutation together with commutation and slot ripples could be expected under the circumstances.

Appendix 1

Deductions from the Quantitative Relationships

Metadyne at Standstill.—If the metadyne is at standstill the constant K becomes equal to zero, and from equations

Fig. 9 (Below)

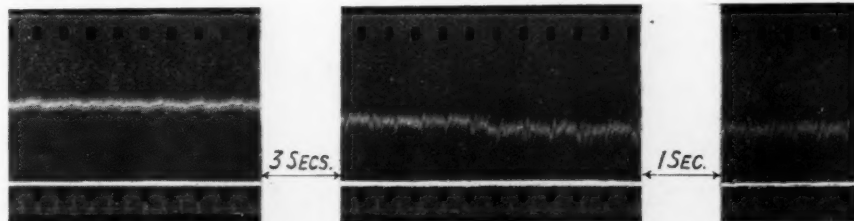
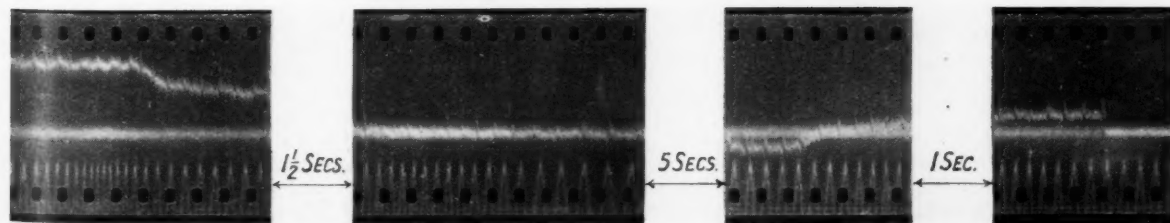


Fig. 10 (Right)



12 and 11 respectively we have, assuming no variator excitation,

$$I_1 = \frac{V_1}{R_a}$$

and

$$I_2 = \frac{E_b}{(R_a + R_2)}$$

Thus, at standstill, the metadyne armature constitutes what is more or less a short-circuit of the supply line and also of the traction motors.

Metadyne Rotating at High Speeds.—If the metadyne armature is rotated at an infinitely great speed, the constant K becomes infinitely large, giving

$$I_1 = 0,$$

and

$$I_2 = 0.$$

Thus, when rotating at a very high speed, the metadyne armature constitutes what is more or less an open-circuit of the supply line and also of the traction motors.

Secondary Circuit Open.—If the load circuit is open, then $R_2 = \infty$, giving

$$I_1 = \frac{(V_1 - K\Phi_v)}{R_a}$$

and

$$I_2 = 0.$$

Thus, with the variator winding unexcited, open-circuit of the secondary side results in a short-circuit of the supply line.

Appendix 2

Effect of a Regulating Winding

The speed of the metadyne armature may be maintained constant by a combined mechanical and electrical action as follows: The current taken by the regulating machine (see Fig. 11) is used to excite a regulating winding fitted on the metadyne stator such that its magnetic axis coincides with that of the primary flux. The direction of the regulator flux Φ_r is arranged such that it interacts with the secondary current I_2 to give a torque T_r which assists in driving the metadyne armature.

It follows that any tendency for the metadyne speed to fall results in an increased regulator current (due to the reduction in the back e.m.f. of the regulating machine) which produces an increase in Φ_r and a tendency to increase the torque T_r to maintain constant rotational speed of the metadyne. Also, any tendency for the metadyne speed to rise results in a decreased regulator current and a tendency to decrease T_r to maintain constant rotational speed of the metadyne. In fact, the excitation of the regulator machine may be arranged such that a small increase in the metadyne speed causes the regulator machine to generate and so produce both mechanical and electrical torques which retard the speed of the metadyne.

The effect of the regulating winding on the metadyne characteristics is determined by modifying equation (2) to

$$E_2 = K(\Phi_1 - \Phi_r)$$

Equation (10) then becomes modified to

$$\Phi_1 = \frac{I_2(R_a + R_2) + E_b + K\Phi_r}{K}$$

Substituting this value of Φ_1 in equation (9) gives

$$I_2 = \frac{KK_1(V_1 - K\Phi_v) - R_a(E_b - K\Phi_r)}{K^2K_1K_2 + R_a(R_a + R_2)} \quad (13)$$

Whilst, combining this value of Φ_1 with equations (3) and (13) we obtain

$$I_1 = \frac{(R_a + R_2)(V_1 - K\Phi_v) + KK_2(E_b + K\Phi_r)}{K^2K_1K_2 + R_a(R_a + R_2)} \quad (14)$$

Since the armature resistance is small, it will be seen from equation (13) that the effect of the regulating flux on the load current will be small. Consequently, the constancy

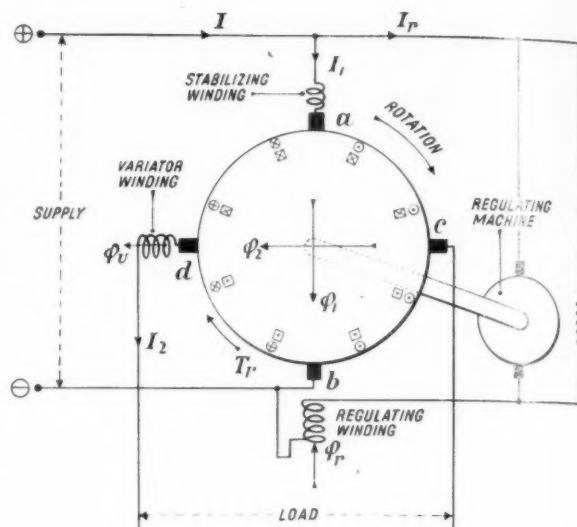


Fig. 11

of the load current is practically unaffected by the presence of the regulating winding.

Resultant Torque on Metadyne Armature.—The primary current I_1 interacts with the secondary flux Φ_2 and the variator flux Φ_v to produce a torque of $k(\Phi_2 + \Phi_v)I_1$ assisting rotation of the metadyne. The quantity k is a constant. The secondary current interacts with the primary flux and the regulator flux to produce a torque of $k(\Phi_1 - \Phi_r)I_2$ assisting rotation of the metadyne. Thus, the resultant torque on the metadyne armature, neglecting any external mechanical torque, is

$$T = k(\Phi_2 I_1 - \Phi_1 I_2) + k(\Phi_v I_1 + \Phi_r I_2)$$

Substituting for I_1 and I_2 we obtain

$$T = k\Phi_1\Phi_2(K_1 - K_2) + k(\Phi_v I_1 + \Phi_r I_2)$$

Consequently, if the primary and secondary magnetic circuits are identical (that is, $K_1 = K_2$), the only torque experienced by the metadyne is

$$T = k(\Phi_v I_1 - \Phi_r I_2)$$

Hence, with the variator winding unexcited, the regulator machine and regulator winding have to exert a sufficient torque to account for only the no-load losses of the metadyne.

With the variator winding excited to assist the secondary

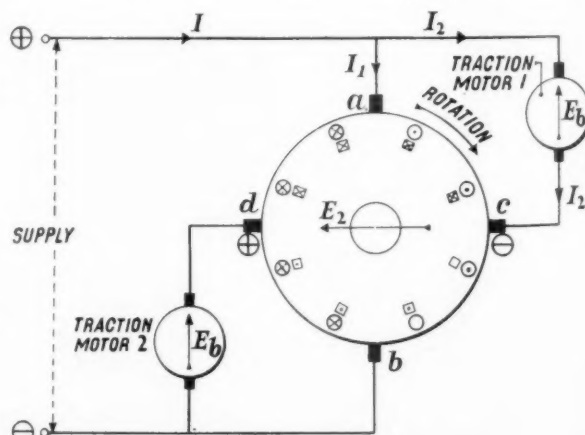


Fig. 12

flux (thereby reducing the load current) the component torque $k\Phi_e I_1$ may itself, on full-load, be more than sufficient to rotate the metadyne against its no-load losses. Under these conditions the regulating machine would act as a generator, and both the electrical and mechanical regulating torques oppose the tendency for the metadyne speed to rise.

A stabilising winding may be added to the stator of the metadyne and excited to give a torque equal and opposite to the component torque $k\Phi_e I_1$. The latter torque would then be neutralised and stable running of the metadyne obtained with the regulating winding and regulator machine exerting only sufficient torque to make up the no-load losses of the metadyne. In order to retain the constant current characteristic of the secondary circuit, it will be evident that the axis of the stabilising winding must coincide with the magnetic axis of the primary flux Φ_1 .

Appendix 3

Figure 8 Connection

The actual current flow in the armature conductors between the brushes *a* and *d* (see Fig. 11), and also between the brushes *b* and *c*, is

$$I = \frac{1}{2}(I_2 + I_1),$$

whilst that between the brushes *a* and *c*, and between *b* and *d*, is

$$I = \frac{1}{2}(I_2 - I_1)$$

Hence, one half of the conductors on the metadyne armature carries a current which exceeds by I_1 that flowing in the remaining conductors. The inherent result of a non-uniform current distribution is an increased total copper loss and a decreased efficiency. It becomes desirable therefore, to rearrange the connections so that I_1 is reduced.

The figure 8 arrangement of the connections (see Fig. 12) attempts to do this by introducing the supply voltage into the load circuit. The quantitative expressions for the primary and secondary currents may once again be deduced from the fundamental relationships, or more readily obtained by comparison with equations (11) and

(12), and substituting the value $(2E_b - V_1)$ for the term E_b . We thus obtain

$$I_2 = \frac{KK_1(V_1 - K\Phi_e) - R_a(2E_b - V_1)}{K^2K_1K_2 + R_a(R_a + R_2)} \quad (15)$$

and

$$I_1 = \frac{(R_a + R_2)(V_1 - K\Phi_e) + KK_2(2E_b - V_1)}{K^2K_1K_2 + R_a(R_a + R_2)} \quad (16)$$

Thus, the presence of the supply voltage in the load circuit scarcely affects the load current at any time, whilst, when $2E_b = V_1$, the primary current has only the small value of

$$I_1 = \frac{(R_a + R_2)(V_1 - K\Phi_e)}{K^2K_1K_2 + R_a(R_a + R_2)}$$

Therefore, with the motors running at the speed (say full speed) which gives $2E_b = V_1$, the current distribution in the metadyne armature is almost uniform and the best possible efficiency is obtained.

On the other hand, at starting of the motors (that is, $E_b = 0$) the primary current has the high value of

$$I_1 = \frac{(R_a + R_2)(V_1 - K\Phi_e) - KK_2V_1}{K^2K_1K_2 + R_a(R_a + R_2)}$$

and so the current distribution is even less uniform than for the case of starting the motors and using the ordinary cross-connection.

It follows that the figure 8 connection gives the better efficiency for those services where the traction motors run at full speed for the major portion of the time, whilst the ordinary cross-connection may give the better efficiency for those services where frequent stopping and starting occurs, particularly if the stops take up a considerable proportion of the schedule time.

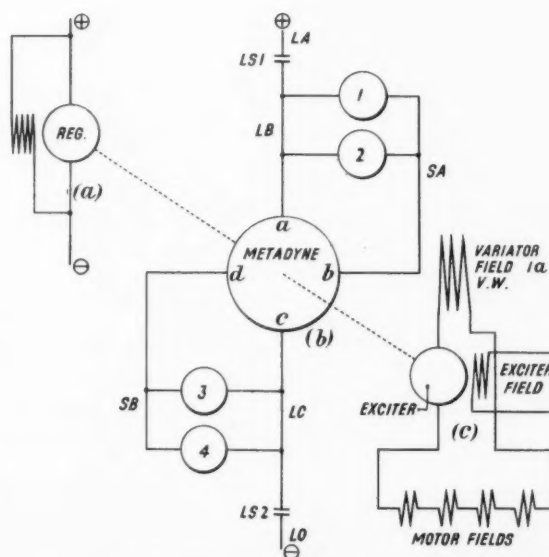
Acknowledgments

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The Metadyne System of Control for D.C. Traction Equipments

THE name *Metadyne* has been given to a special type of d.c. machine in which special use is made of armature reaction to control the machine characteristic. The special constructions and their applications are covered by numerous patents taken out by Mr. J. M. Pestarini, and the British rights of these patents are held by the Metropolitan-Vickers Electrical Co. Ltd., which has developed the principle for various applications, including power control on d.c. traction equipments. A notable example of this application is found in the multiple-unit train equipments supplied by Metrovick to the London Passenger Transport Board.

Metadynes can be built to act as motors, generators, or transformers of d.c. power, and it is this last-named type which is applied to the train control. It is arranged to convert power from constant voltage to variable voltage so as to give any desired speed-torque characteristic to the traction motors from standstill to full speed and from



Simplified diagram of metadyne control equipment

full speed to stop. This control is accomplished inherently by the metadyne, which automatically gives a variable boost to the back e.m.f. of the traction motors in order to balance the line volts, overcome the C.R. drop of the machines and so produce the desired speed-torque characteristic. The metadyne thus takes the place of the starting resistances, accelerating relays, switches, cam groups, &c., of the equipment commonly used for train control, and in addition it provides means for the regenerative control of the machine to a standstill. The power wastage ordinarily involved in resistance losses is thereby avoided, while the smooth control has obvious advantages over the use of stepped resistances.

The shape of the speed-torque characteristic can, if it is so desired, be varied at will by the driver. It is possible therefore to arrange the equipment to operate automatically to a schedule or to give the flexibility of control of the steam locomotive, without the peaks and drops in tractive effort which are involved with the resistance notching and transitions of standard methods.

The circuit arrangement used in these equipments is shown in simplified form in the accompanying diagram. The metadyne set consists of three commutator-type machines mounted on a common shaft. The machines are:

(a) a regulator, which starts the set and keeps it running at a fixed speed; (b) the metadyne proper, which feeds the armatures of the traction motors; (c) an exciter, which provides excitation for the metadyne variator winding and the fields of the traction motors.

The regulator in its simplest form is a shunt machine.

and the exciter is a generator with a separately-excited field winding. The metadyne itself consists of an armature of ordinary type, with commutator, and a stator which has four main poles and four brush arms. A constant voltage supply is fed to the primary brushes *a* and *c* and the load is connected between brush *a* or *c* and the corresponding secondary brush *b* or *d*. The back e.m.f. of the machine at the brushes *a* and *c*, produced by armature reaction due to the current in the motor circuits, tends to maintain itself constant, any tendency to increase of current in the motor circuit producing a checking increase of back e.m.f. and *vice versa*. A stable condition is thus produced, in which the motor load current is maintained constant irrespective of the motor speeds.

The variator winding provides means for controlling the motor current by superimposing on the axis of armature reaction a separately-excited flux, subtracting from the effect of armature reaction, so that more current is drawn from the line and the current in the motor circuits is increased. By suitable control of the exciter field any desired characteristic can thus be given to the motors.

In regeneration, in order to avoid excessive voltage on the metadyne brushes, the motor armatures are connected across the brushes *a-d* and *b-c*. In this case the motors are acting as generators, but here again, since the back e.m.f. tends to maintain itself constant, the currents in the motor circuits remain substantially constant unless modified by the variator winding. The current delivered to the line gradually diminishes as the train speed falls, until at low speeds and standstill the braking effort is actually maintained by current drawn from the line.

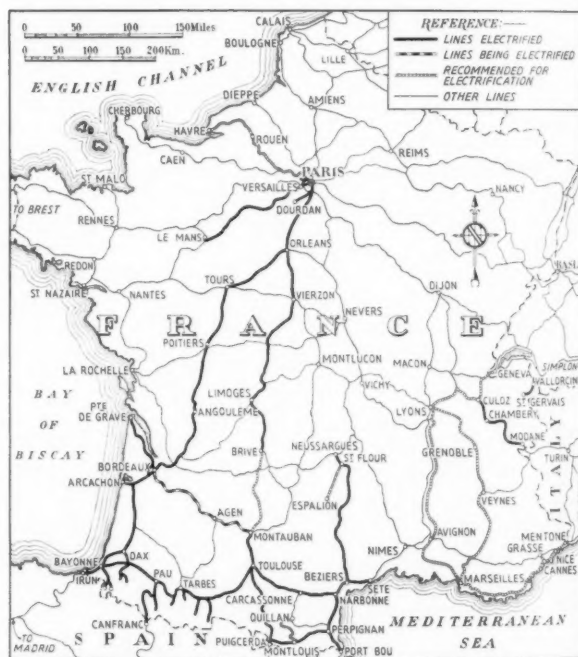
Tours-Bordeaux Main-Line Conversion

THE electrification of the ex-P.O.-Midi Railway's main line between St. Pierre des Corps and Bordeaux has advanced so far that a partial electric service was introduced between St. Pierre and Poitiers on June 17, and was extended from Poitiers to Angoulême on July 5. It is expected that the conversion work over the remaining 86 miles from Angoulême to Bordeaux (St. Jean) will be finished by the end of October, and that an electric service will be in operation by the end of the year.

It will be recalled that, like the Paris—Le Mans electrification completed last year, the conversion of the St. Pierre—Bordeaux line was included in the so-called Marquet plan of 1934, the object of which was to provide employment.

The proposals for the electrification of the St. Pierre—Bordeaux line received Government sanction in November, 1935, so that the conversion of the 215-mile double-track line, comprising probably about 500 track miles, will have taken three years. The system adopted is the French standard 1,500-volt d.c. with overhead current collection, and with power supplied through a 90 kV. transmission network carrying current generated in the Marège and Coindre hydro-electric stations in the Massif Central. The 90 kV. system more or less follows the railway route. At the northern end it is linked up with the last substation—Epines-Fortes—of the Les Aubrais—St. Pierre electrified section, and at the southern end with the Pessac transforming station, near Bordeaux. There are two feeding points, at Chaumont, near Poitiers, and at Fléac, near Angoulême.

The high-tension current is converted to the line current in 14 automatic substations of the same general type as those installed on the Les Aubrais—St. Pierre and



Map of French electrified lines. The Tours-Bordeaux section is due to be completed throughout by the end of the year

Vierzon—Brive sections. Express trains are being operated by the standard P.O. 2-Do-2 electric locomotives and by new locomotives of the same wheel arrangement. Freight and slow passenger trains are being handled by the usual Bo-Bo locomotives.